



E3 User's Manual

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Developed by Elipse Software, **E3** is a powerful platform for supervising and controlling processes, fully focused on network operation and distributed applications. E3 is a SCADA (*Supervisory Control and Data Acquisition*) system that offers an advanced object model, a powerful graphical interface, in addition to an architecture allowing fast application development and maximum connectivity to devices and other applications. Its concept incorporates state-of-the-art technologies in software development, increasing performance, productivity and quality of applications, as well as the process itself, thus reducing costs and losses.

Systems built with E3 usually start from real time data collection from data or control acquisition devices, such as PLCs (*Programmable Logic Controllers*), RTUs (*Remote Terminal Units*), DAQs (*Data Acquisition Boards*), Multi-Loop or Single-Loop controllers, fire centers and weighing machines, among other devices. These equipments usually have some interface allowing its connection to the software, such as standard serial RS232, RS422, or RS485; radio or modem (private or dial-up lines), TCP/IP or UDP/IP, boards directly linked to the computer bus, and others. E3 reads and writes data from the equipment through modules (I/O Drivers) that implement the protocol available in each one of them (public or private domain). These Drivers can still be in an Elipse Software format or in OPC format (*OLE for Process Control*).

With this data, users can create many ways to display, analyze, control, command, store, or disclose such information, among them:

- **Screens:** allows creating an HMI (*Human-Machine Interface*) locally, through local network or Internet, aiming at displaying current or past data status in many ways, using a graphical editor and specific objects
- **Alarms and Events:** monitors the occurrence of specific situations
- **Historics:** stores data in relational databases
- **Reports:** allows viewing and printing data, among other modules and possibilities

1.1 General Description

E3 can be executed on **Windows XP SP3, Windows XP x64 SP2, Windows Vista SP2, Windows 7 SP1, Windows 8, Windows 8.1, Windows 10, Windows Server 2003 SP2, Windows Server 2008 SP2, Windows Server 2008 R2 SP1, Windows Server 2012, or Windows Server 2012 R2** platforms, using some features available in these operating systems. Its graphical user interface can also run on Internet or intranet via Internet Explorer.

Basic software functions are divided into independent modules, which can process specific activities. Information traffic management among all modules is coordinated by a main module (E3 Admin), using a technology based on distributed objects, allowing components to run either on the same machine or on other computers.

Briefly, E3 consists of a kernel responsible for binding and coordinating the work of several other modules, which are also information servers. From this point on, the graphical user interfaces are generated, which are available via either local or Internet clients.

E3 has four main programs, described on the next topics.

1.1.1 E3 Server

This is the Application Server, where main processes run, including real-time communication with control equipments. The server is also responsible for sending data and Screens to clients connected anywhere on the network (intranet and Internet). The server can run many projects at the same time and exchange data with other E3 Servers to accomplish a fail-over (standby) or to distribute processing loads among the machines.

1.1.2 E3 Studio

Unique configuration tool, acting as a universal development platform with a modern and friendly environment, including a full graphical and script (VBScript) editor. This allows a project to be edited by many users at the same time, or that many E3 Studios to be connected to the same remote server, with multiple configurations.

1.1.3 E3 Viewer

Allows operating applications residing in the server from any computer running the Viewer executable program or with an Internet browser. In both cases it is not necessary to install the application in the client computer, because all components (Screens, libraries, ActiveX controls) will be automatically downloaded and registered.

1.1.4 E3 Admin

This module is responsible for E3 Server and other E3 module interfaces with users. With it, users can send commands to an E3 Server, by using its icon on Windows Notification Area, and also control the Domain via command line.

1.2 Architecture

To supervise a specific process with a SCADA system, usually an application containing the definition of variables involved is built up, with names and paths, Screens, definitions of alarms and others, which is called an **Application Database**.

When this process requires using two or more computers, there is a need to make sure that each application on each computer exchange data with the others. Most traditional SCADA systems were based on a common structure to accomplish this task:

- Each SCADA server must have a copy (partial or not) of the application configured on the local database
- Each SCADA server has and runs only one database at a time

This lead to some management problems, such as applying changes to all servers, controlling application versions, or else working with different software and hardware manufacturers.

E3 solves this problem by using the concept of **Domain**, which includes in one single environment the definition of the computers running real-time tasks (servers) and the project databases that must be executed in these servers, with the possibility of running many projects in each server. Users can also add, delete, or modify projects at run time, without affecting other parts of the running Domain.

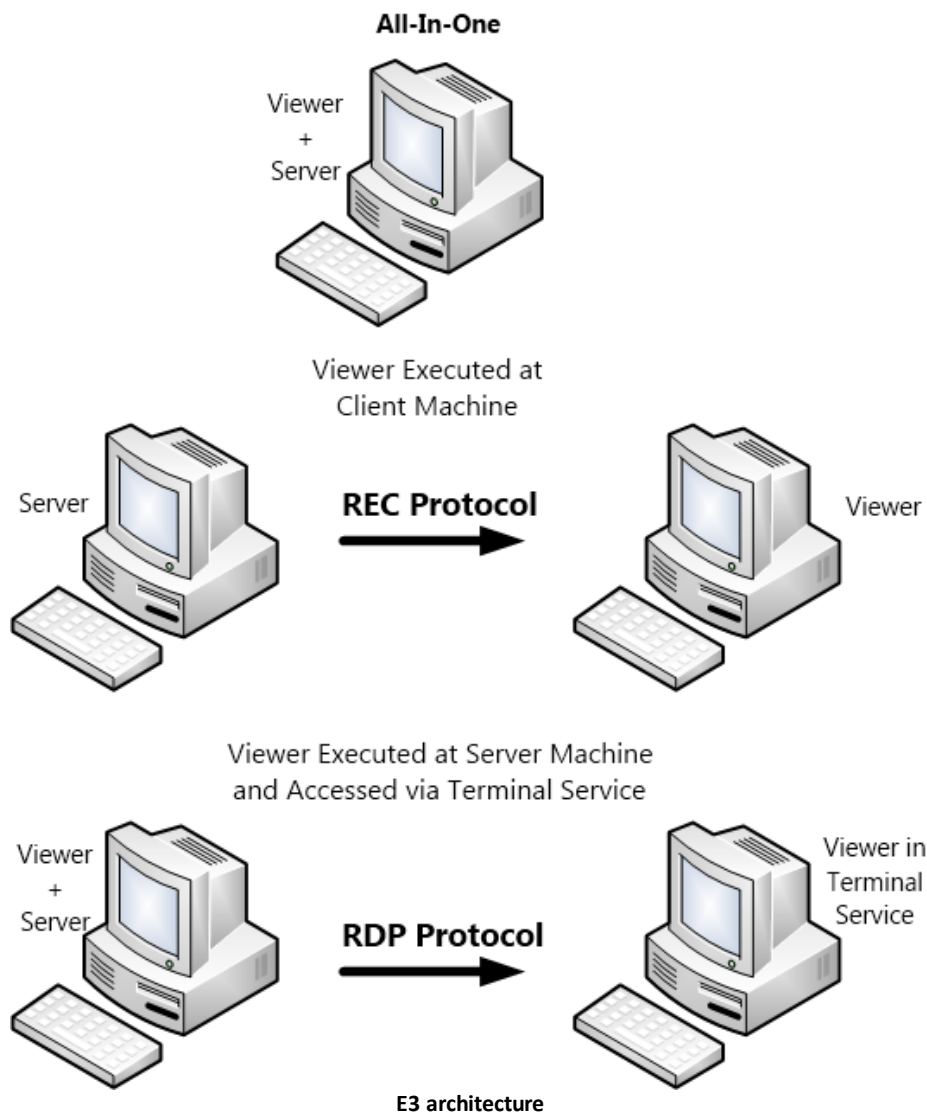
Each project can contain any type of object, such as Screens, I/O Drivers, Alarms, Historics, Reports, Formulas, Databases, among others. When two or more projects are within the same Domain, they can access properties and objects among themselves as they reside on a single database. This is possible by using Links (connections) that an object can perform with any other. If both objects exist and are running, the connection is active and any value change is asynchronously sent among the objects (depending on the connection type). If one of the objects is destroyed or stopped, the connection is broken, then the application is notified about it and can then indicate that status in a user-defined way.

The Domain structure is restricted to servers and similar, such as server machines, projects, users, and passwords. The client interface for operation and visualization, called E3 Viewer, can connect to any E3 Server directly (with proper Viewer licenses). The E3 Viewer has three special features:

- Application projects reside exclusively on the server
- Internet Explorer can be used as an operating interface, without any change
- The client interface can alternate from a switched off server or a failed one to the next available server, without interrupting the monitoring process

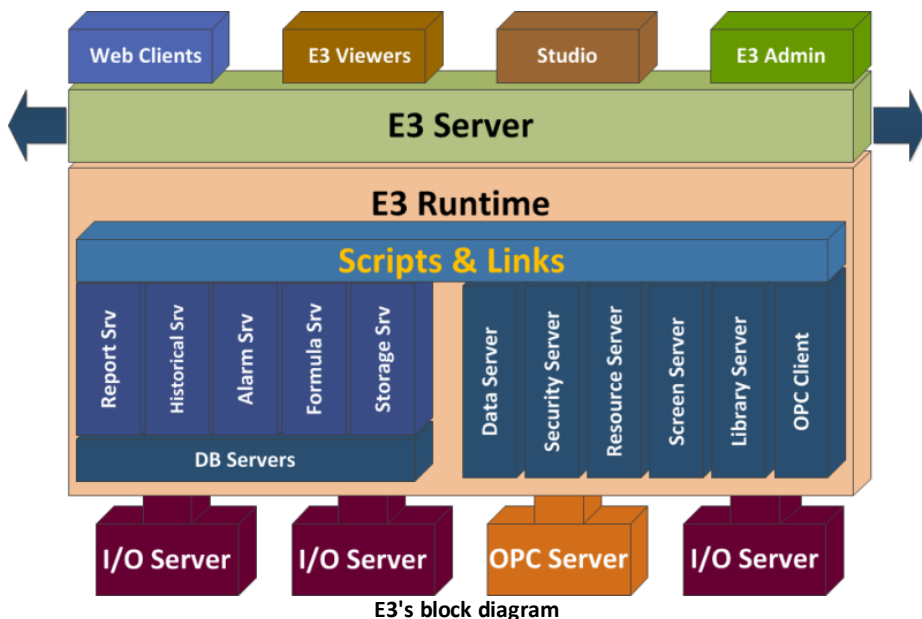
One alternative for using E3 Viewer on the client machine is using the **Terminal**

Service technology. This is a service that began with Windows NT 4.0, and its function is to allow remote access among computers via a protocol called RDP (*Remote Desktop Protocol*). This protocol allows interaction between a client station and a server machine (which is accessed remotely). An E3 Viewer is executed in a new user session created on the server machine which, by its turn, transfers video data to the client machine, and receives back mouse and keyboard events.



1.3 Block Diagram

E3's internal architecture is completely scalable, with each main task run by a separate service. The following diagram shows an overview of its main blocks.



1.4 Domain Structure

Each group of servers is composed of either one E3 Server operating isolated, or two E3 Servers in a **Hot-Standby** configuration. Actually, each Viewer connects to a Domain rather than to a single server.

After connecting, server and client exchange information and check for the existence of registered and updated system objects on the client computer. If such objects are not found, the server uploads object definitions, such as user libraries, according to the need to open each Screen.

From a client's point of view, the download starts on the first Screen (graphical interface), including any internal objects that will be saved to a cache directory. This process can take a few seconds, depending on the application, but it brings more benefits next time the user opens the same Screen, because the Viewer performs disk and memory cache. If the Viewer is not closed, by the second time a Screen is opened (and it is not reconfigured) it is already in memory, thus reducing pagination time. If the Screen is modified, the Viewer must download it again and restart the process.

After opening a Screen, the server and the client exchange only real-time data and queries to the database using a TCP/IP message system, with high performance

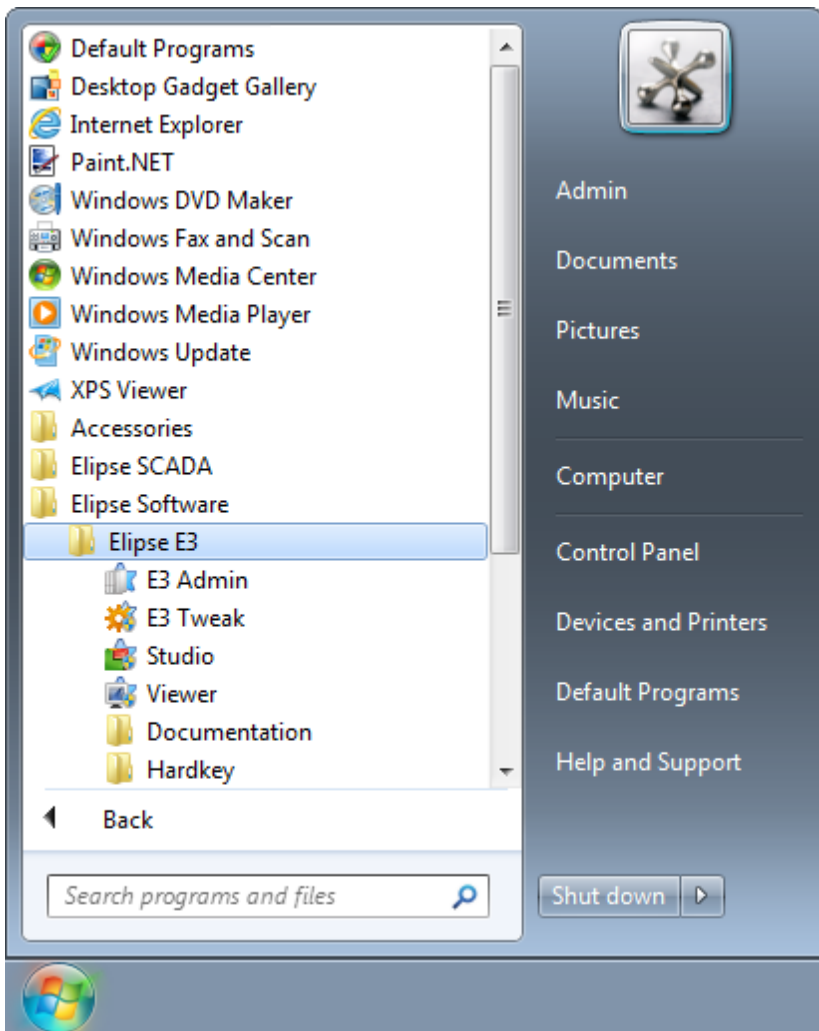
when compared to Terminal Services, depending on the application. This is possible because while E3 Viewer receives and sends only real-time values and data, a Terminal Services client sends keyboard and mouse messages and receives images, generating a higher information traffic. A Viewer connected to an isolated Domain can get information residing only on the active server, according to user access permissions.

1.5 Limitations of Demonstration Mode

Without a license, E3 can be executed in **Demonstration** (or **Demo**) mode, which is useful for software evaluation. In this case, the following limitations apply:

- Allows saving projects with up to 20 I/O Tags
- Does not allow working with servers in **Hot-Standby** mode
- Does not allow working with Remote Domains
- Only allows communicating with one Level 0 (zero) I/O Driver, without Tag limitations. Drivers with level greater than 0 (zero) are not allowed
- Does not allow access to Domain configurations (the E3 Admin's **Domain - Options** contextual menu on Windows Notification Area)
- Only the first image of each category in the Symbols Gallery is available
- Only allows opening one Viewer or WebViewer
- The maximum execution time of a Domain is two hours
- Only allows recording up to 20 I/O Tags on a Storage object
- Allows access as an OPC Server
- Allows executing a playback of the last six hours of data, relative to the current server time, with an unlimited number of Tags, and all playback resources enabled
- Does not allow using E3 Studio's Import and Export tool

E3 Studio is E3's development environment. With it, users can create and maintain Domains, projects, and libraries.



Path indicated by the system when E3 is installed

To start an application in E3 Studio, follow these procedures:

1. During installation, a program group is created on Windows **Start** menu. To

start E3 Studio, select the corresponding icon on this menu, as shown on the previous figure, or click the icon created on Windows Desktop area, according to the next figure.

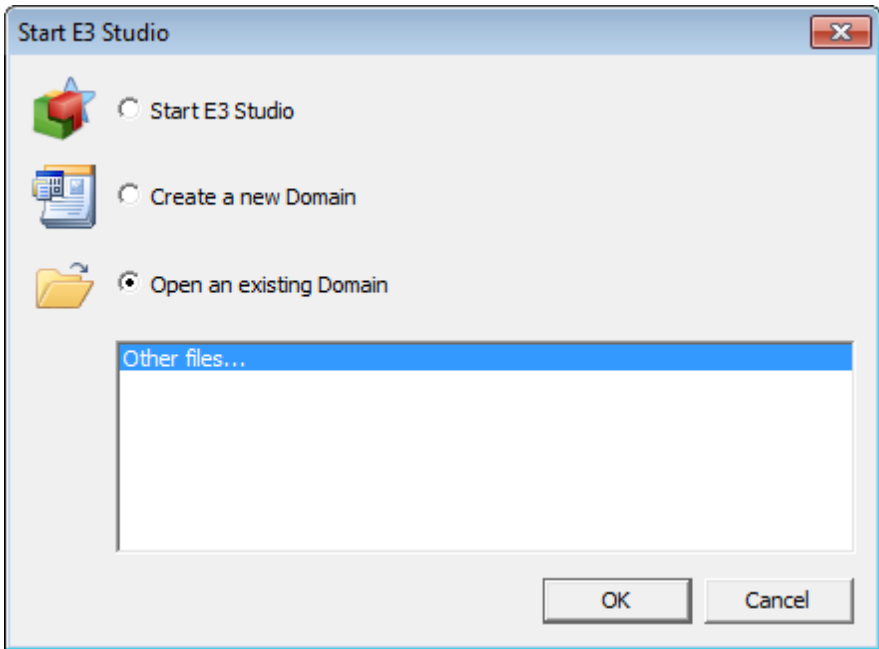


E3 Studio icon

2. A protection device must be connected to the correct I/O port, for a local edition, or this machine must be on the same local network that another one with an E3 Server already installed, and with a protection device.

2.1 Starting a Project

When E3 Studio starts, it opens a dialog box with some options for a project, according to the next figure.



Start E3 Studio window

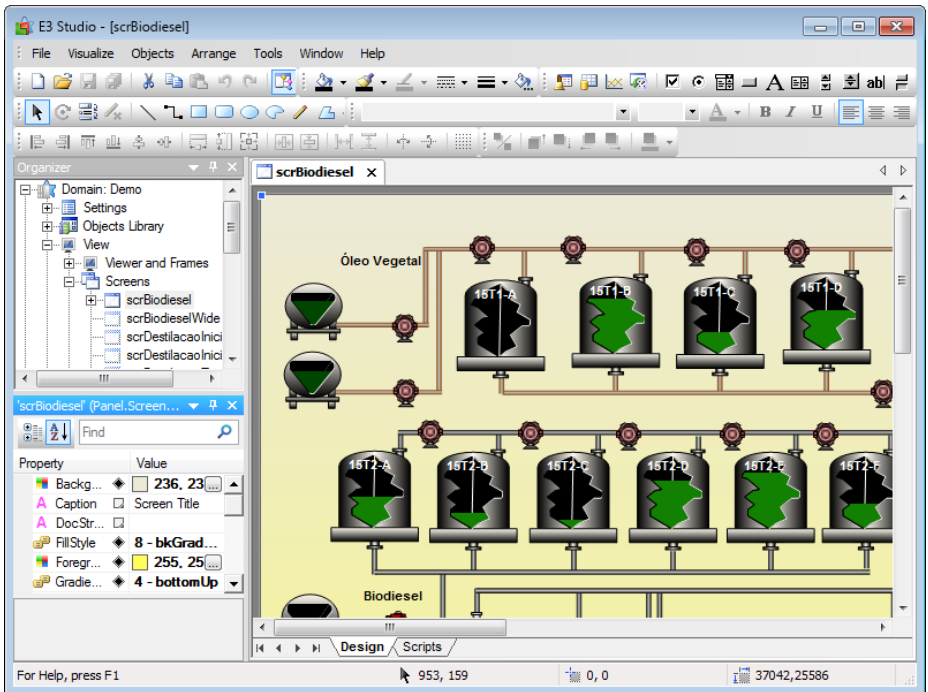
The available options on this dialog box are described on the next table.

Available options for Start E3 Studio window

OPTION	DESCRIPTION
Start E3 Studio	No Domain is opened.
Create a new Domain	Requests a name and a path for a new Domain.
Open an existing Domain	When clicking Other Files , users can locate a Domain on a specific folder, or select it on the list of the last edited applications.

2.2 Working Area

E3 Studio comes with a series of configured menus and toolbars, which are shown when executing it for the first time. When using a more modern graphical interface, similar to programs such as Microsoft Office, users can modify these menus and toolbars. When there is no open application, a screen displays less enabled options on menu bar and on toolbar, but its layout remains the same. The next figure shows E3 Studio's appearance after creating a new project.



E3 Studio's working area

A **Title Bar** shows application's path and name, or the name of an object whose view is currently shown on working area.

A **Status Bar** shows help information about the screen area under mouse pointer.

A **Toolbar** shows objects, components, and other resources that can be used on Screen and on E3.

A **Working Area** is where views are displayed.

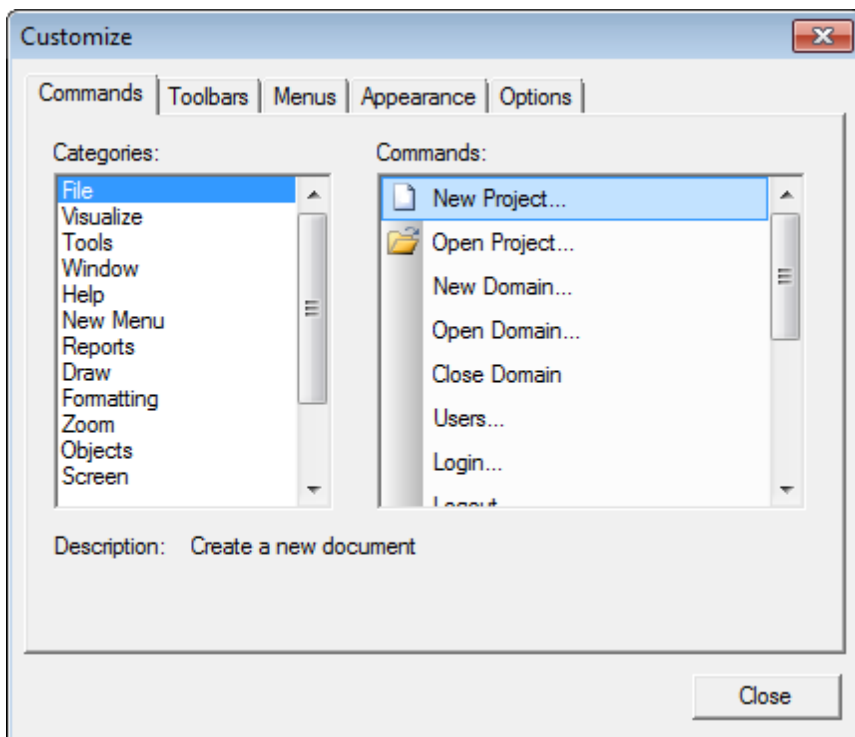
2.3 Settings

E3 allows users to personalize some E3 Studio resources, such as toolbars, keyboard, menus, mouse, etc.

2.3.1 Appearance

To customize E3 Studio appearance, click the **View - Customize** menu. The available options are:

- **Commands tab:** Defines icons for every toolbar. To do so, click an icon on **Commands** list and drag it to the preferred toolbar



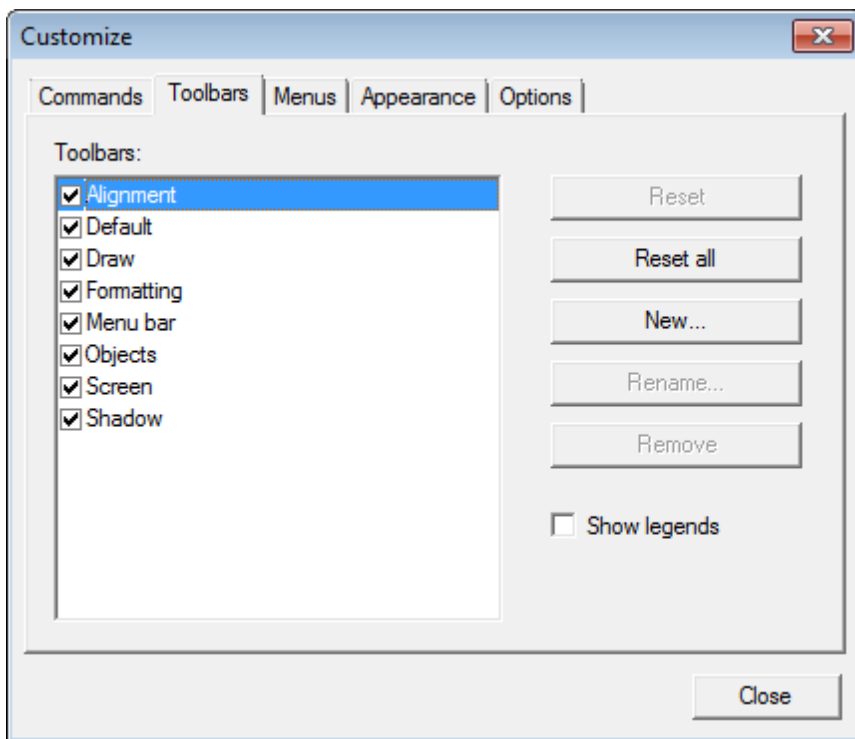
Commands tab

The available options on this tab are described on the next table.

Available options for Commands tab

OPTION	DESCRIPTION
Categories	Shows menu and toolbar options available in E3 Studio
Commands	Shows all items composing the selected menu or toolbar
Description	Shows a short description of the selected option

- **Toolbars tab:** By using this tab, users can configure, edit, or create new toolbars



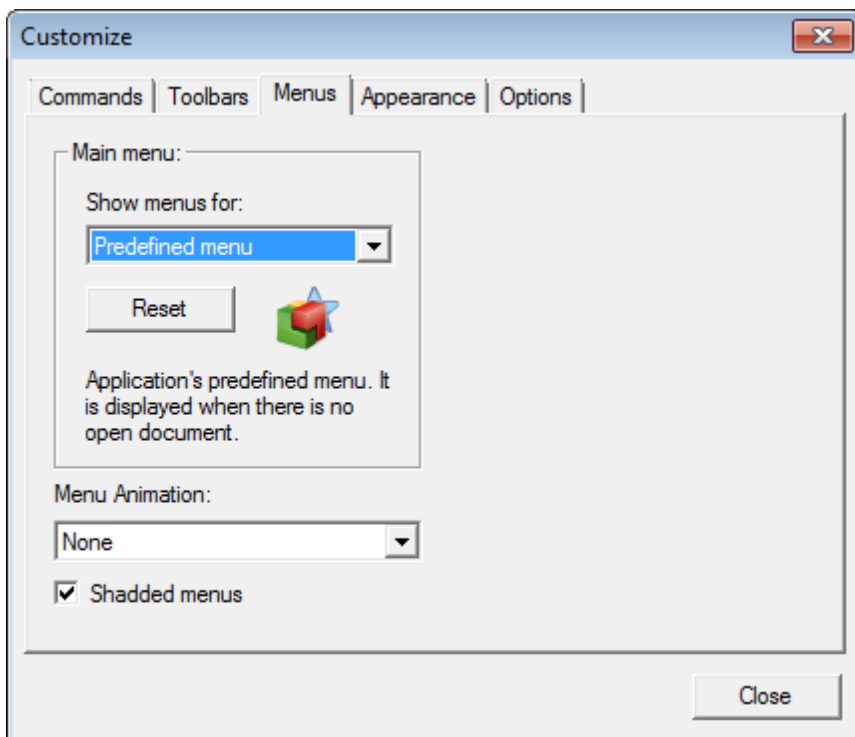
Toolbars tab

The available options on this tab are described on the next table.

Available options for Toolbars tab

OPTION	DESCRIPTION
Toolbars	Lists all available toolbar options
Reset	Restores a toolbar in E3
Reset all	Restores all toolbars in E3
New	Creates a new toolbar
Rename	Changes toolbar's name. Used only for toolbars created by clicking New .
Delete	Removes the selected toolbar.
Show legends	Shows captions on the options of the selected toolbar.

- **Menus tab:** Configures E3 menus



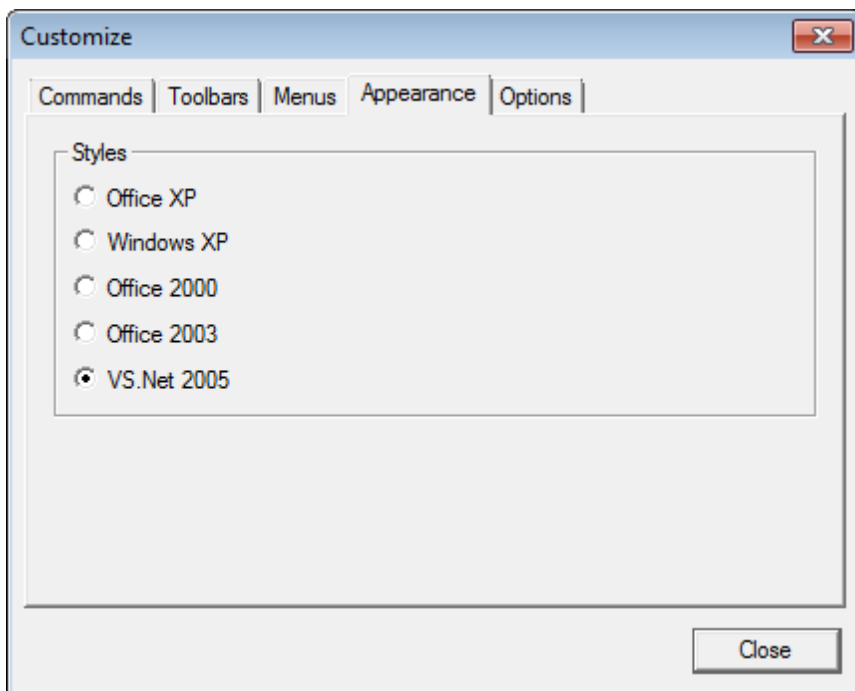
Menus tab

The available options on this tab are described on the next table.

Available options for Menus tab

OPTION	DESCRIPTION
Show menus for	Displays application's pre-defined menu. This option has no effect, and it is kept in E3 for compatibility reasons
Reset	Resets the menu defined in the previous option. This option has no effect, and it is kept in E3 for compatibility reasons
Menu Animation	Selects the type of animation used by menus: None (E3 standard option), Unfold , Slide , Fade , and Default (Windows standard option)
Shaded menus	Defines whether a menu displays a shaded effect

- **Appearance tab:** Changes the appearance of windows and toolbars in E3 Studio



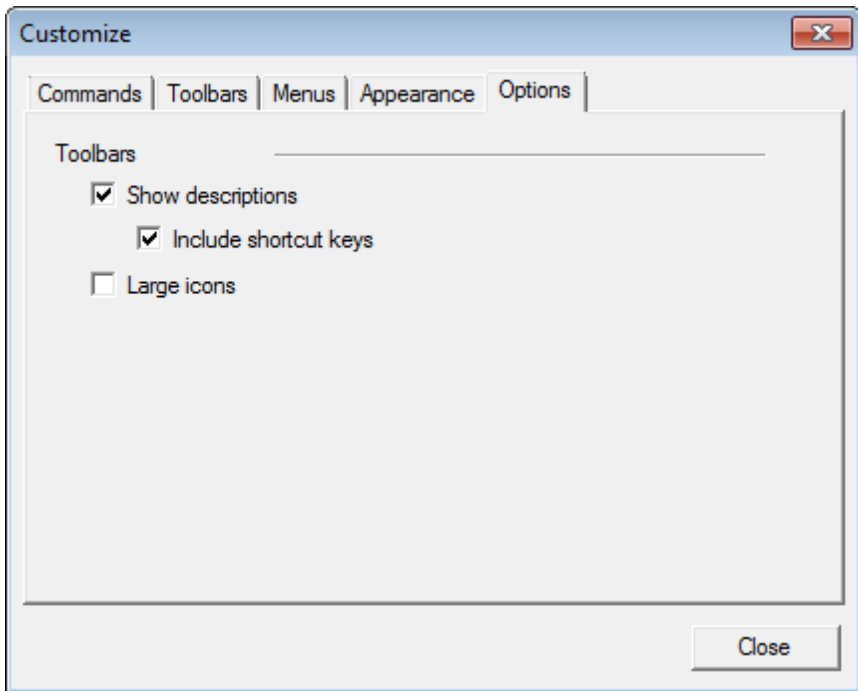
Appearance tab

The available options on this tab are described on the next table.

Available options for Appearance tab

OPTION	DESCRIPTION
Office XP	Configures E3 Studio's appearance as in Office XP
Windows XP	Configures E3 Studio's appearance as in Windows XP (not available in Windows Classic style)
Office 2000	Configures E3 Studio's appearance as in Office 2000
Office 2003	Configures E3 Studio's appearance as in Office 2003
VS.Net 2005	Configures E3 Studio's appearance as in Visual Studio .NET 2005

- **Options tab:** Configures project's general specifications. Enables or disables toolbar options



Options tab

The available options on this tab are described on the next table.

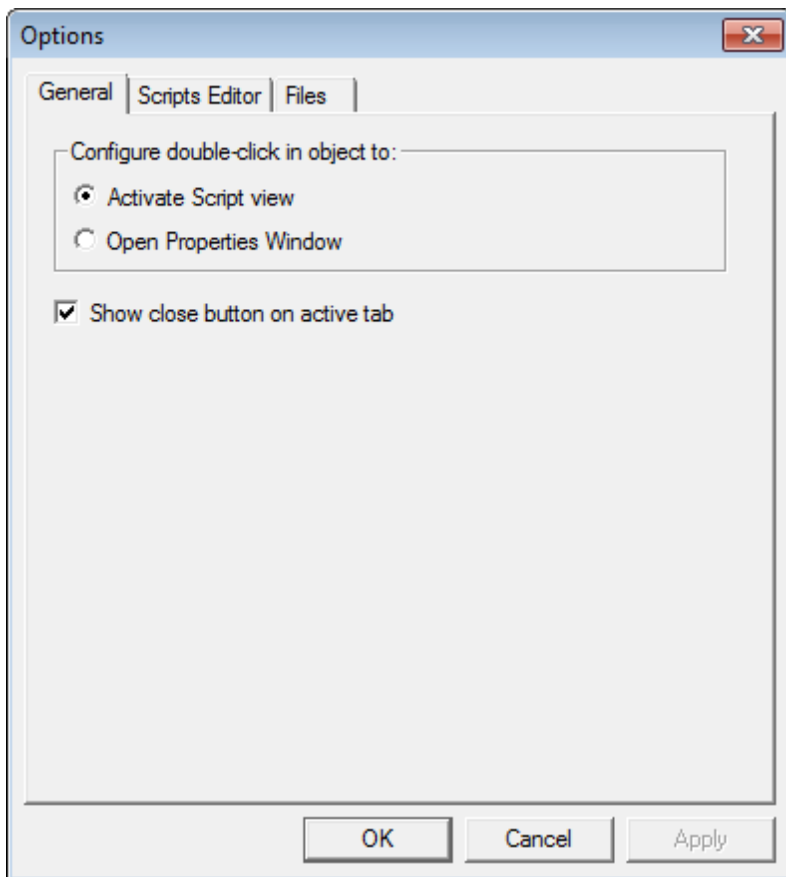
Available options for Options tab

OPTION	DESCRIPTION
Show descriptions	Enables E3 to show a brief description on toolbar and menu options, whenever mouse pointer is over an item
Include shortcut keys	Shows or hides shortcut keys on button's description
Large icons	Enables large icons on a toolbar

2.3.2 Other Settings

Users can configure E3's Scripts Editor, as well as other options for Domain files by using the **Tools - Options** menu, where users have access to the configuration window on the next figures.

- **General tab:** Configures the behavior when double-clicking objects in Organizer, when an object's view is already open



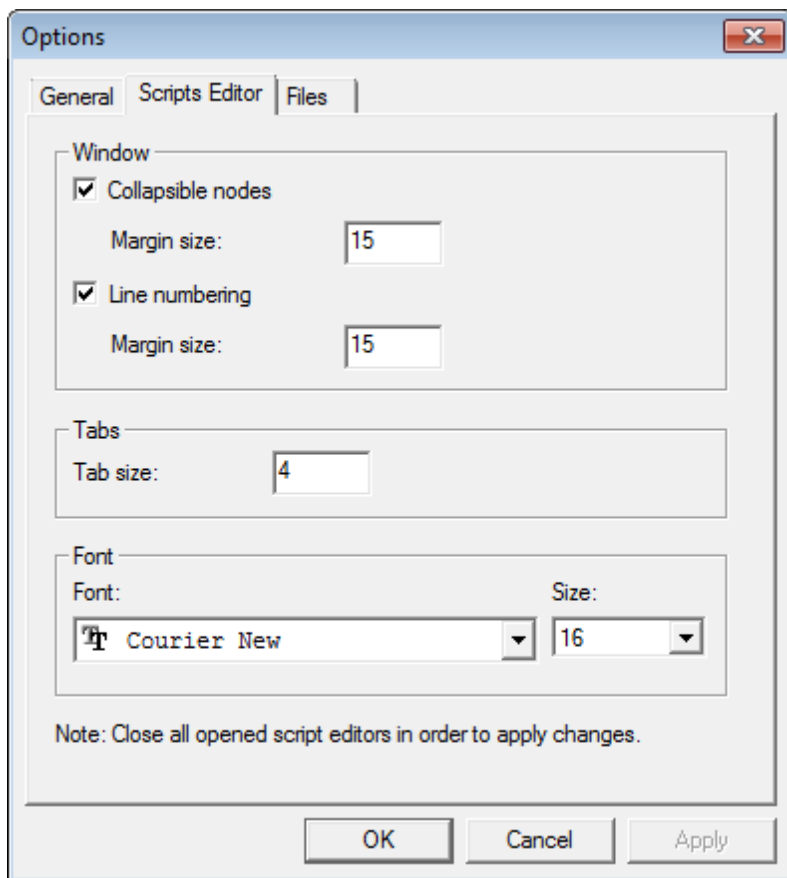
General tab

The available options on this tab are described on the next table.

Available options for General tab

OPTION	DESCRIPTION
Activate Script view	Activates the Scripts view when double-clicking an object
Open Properties Window	Opens the Properties Window when double-clicking an object
Show close button on active tab	Allows closing the active tab when clicking its Close button. Clearing the selection of this option places the Close button on view's right side

- **Scripts Editor tab:** This item configures E3's Scripts Editor



Scripts Editor tab

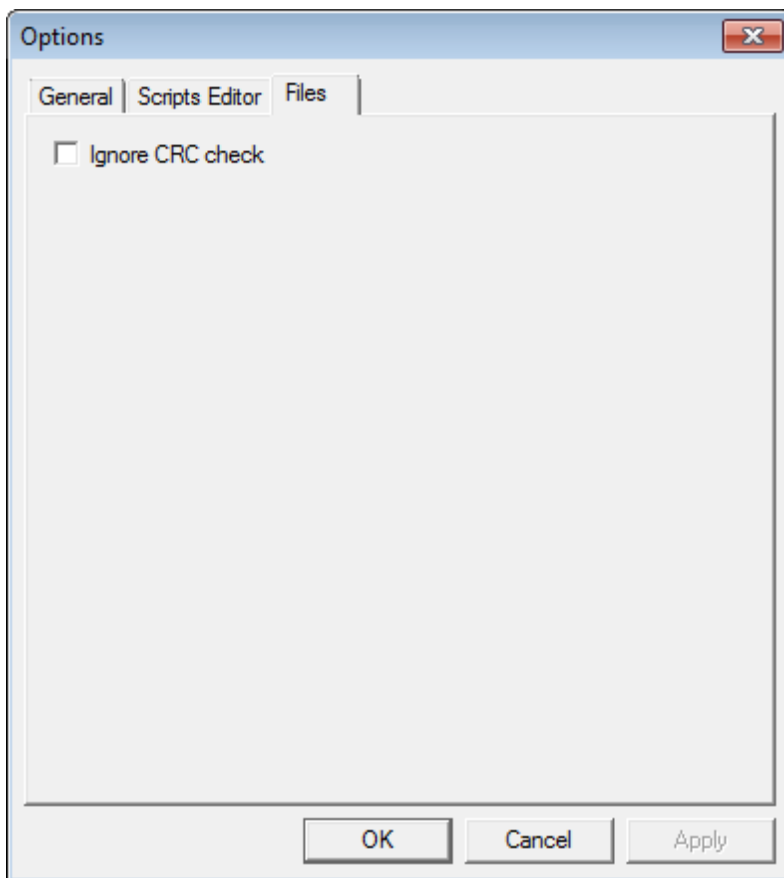
The available options on this tab are described on the next table.

Available options for Scripts Editor tab

OPTION	DESCRIPTION
Collapsible nodes	Allows hiding or displaying code blocks in scripts
Margin size	Size of the margin containing code blocks
Line numbering	Enables line numbering in Scripts Editor
Margin size	Size of the margin containing the line numbering
Tab size	Determines the number of tab spaces
Font	Determines the name of the font used in Scripts Editor
Size	Determines the size of the font used in Scripts Editor

NOTE: Close all open Scripts Editors to apply these changes.

- **Files tab:** Enables or disables the **Ignore CRC check** option



Files tab

Every time a project or library is created, E3 internally stores a CRC (*Cyclic Redundancy Check*) code for this file's data. Every time a file is opened, this CRC code is then checked. In case that check fails, that is, its CRC code does not match data, loading this file is aborted, indicating file's data corruption. This may be due to hardware failures such as memory, network, storage device, etc.

However, if a project created with the latest version is then modified in a version previous to 1.00.019 build 203, this CRC code is not updated. This means that a file cannot be opened again in new versions, because its CRC check fails, even though this file is not corrupted. To solve this question, enable the **Ignore CRC check** option. Thus, a project can be opened in the current version.















In this case, this option must remain enabled until all objects edited in previous versions are saved by the current version, which then updates its CRC code.













NOTE: It is not recommended to edit .prj files in older versions of E3 and then open these files in new versions, because there is no guarantee that file settings are not lost during this procedure.

2.4 Toolbars







E3's **Toolbar** changes whether there is an open application or not. Toolbar buttons allow users to perform certain tasks quickly, without using menus. This way, users can create Screen Objects or open the Organizer simply by clicking a toolbar button. The next table shows all available options for E3 Studio's several toolbars.

Available options for Default toolbar












ICON	COMMAND	ACTION
	New Project	Creates a new project.
	Open Project	Opens an existing project.
	Save Project	Saves a project.
	Save All	Saves the whole Domain.
	Cut	Removes selected information and transfers it to the Clipboard.
	Copy	Copies selected information and transfers it to the Clipboard.
	Paste	Pastes selected information from the Clipboard.
	Undo	Undoes the last action executed.
	Redo	Redoes the last action executed by the Undo item.
	Organizer	Shows or hides the Organizer.
	Gallery	Shows or hides the Gallery.
	Property List	Shows or hides the Property List.
	Show in Editor	Shows an object in the object's view, if it is selected in the Organizer.
	Show in Organizer	Shows an object in the Organizer, if it is selected in the object's view.

ICON	COMMAND	ACTION
	Saves and Runs the Domain	Saves all projects and libraries, runs a Domain, and then opens Viewer.
	Run or Stop Domain	Runs or stops the current Domain.
	Run or Stop E3 Viewer	Runs or stops E3 Viewer.
	Check Domain	Checks if a Domain contains errors.
	Previous Error	Shows the previous error found in a Domain.
	Next Error	Shows the next error found in a Domain.
	Defragment Files	Defragments the specified file.
	Find and Replace	Searches for all occurrences of a given text in the whole Domain.
	Domain's Object Counting	Displays a window with the amount of objects available in a Domain, separated by classes sorted alphabetically or grouped by modules.
	Script Documentation	Generates a documentation for scripts.
	Version Report	Shows project and library versions.
	WatchWindow	Shows Tag and property values in E3 Studio, at run time.







Available options for Shadow toolbar


















ICON	COMMAND	ACTION
	Object Shadow	Applies a shadow to an object.
	Move Shadow Up	Moves object's shadow up.
	Move Shadow Down	Moves object's shadow down.
	Move Shadow Left	Moves object's shadow to the left.
	Move Shadow Right	Moves object's shadow to the right.
	Shadow Color	Selects object's shadow color.

Available options for Objects toolbar

ICON	COMMAND	ACTION
	E3Alarm	Inserts an E3Alarm -type object.
	E3Browser	Inserts an E3Browser -type object.
	E3Chart	Inserts an E3Chart -type object.
	CheckBox	Inserts a CheckBox -type object.
	OptionButton	Inserts an OptionButton -type object.
	ComboBox	Inserts a ComboBox -type object.
	CommandButton	Inserts a CommandButton -type object.
A	Label	Inserts a Label -type object.
	ListBox	Inserts a ListBox -type object.
	ScrollBar	Inserts a ScrollBar -type object.
ab 	TextBox	Inserts a TextBox -type object.
	SpinButton	Inserts a SpinButton -type object.
	ToggleButton	Inserts a ToggleButton -type object.

Available options for Screen toolbar















ICON	COMMAND	ACTION
	Select	Enables a selection mode.
	Rotate	Enables a rotation mode.
	Tab Order	Shows an identification for a browsing order among objects.
	Edit Connection Points	Allows editing connection points among objects. This button is only enabled in XControl objects.
	Line	Inserts a Line -type object.
	Connector	Inserts a Connector -type object.

ICON	COMMAND	ACTION
	Rectangle	Inserts a Rectangle -type object.
	Round Rectangle	Inserts a Round Rectangle -type object.
	Ellipse	Inserts an Ellipse -type object.
	Arc	Inserts an Arc -type object.
	Freehand	Inserts a Freehand -type object.
	Polygon	Inserts a Polygon -type object.
	Curved Polygon	Inserts a Curved Polygon -type object.
	Picture	Inserts a Picture -type object.
A	Text	Inserts a Text -type object.
	Display	Inserts a Display -type object.
	SetPoint	Inserts a SetPoint -type object.
	Scale	Inserts a Scale -type object.
	Group	Groups an object selection.
	Ungroup	Ungroups an object selection.
	Linear Slider	Inserts a tool for linear sliding.
	Rotation Slider	Inserts a tool for rotation sliding.
	Bring to Front	Brings an object to the front inside a group (ALT + HOME).
	Send to Back	Sends an object to the back inside a group (ALT + END).
	Bring Forward	Brings an object forward inside a group (ALT + PAGE UP).
	Send Backward	Sends an object backward inside a group (ALT + PAGE DOWN).
Zoom ▾	Zoom	Edits Screen's zoom level.
Layers ▾	Layers	Edits Screen's object layers.






Available options for Draw toolbar

ICON	COMMAND	ACTION
	Background Color	Defines object's background color.
	Foreground Color	Defines object's foreground color.
	Border Color	Defines object's border color.
	Border Style	Defines object's border style.
	Border Thickness	Defines object's border thickness.
	Fill Style	Defines object's fill style.

Available options for Alignment toolbar

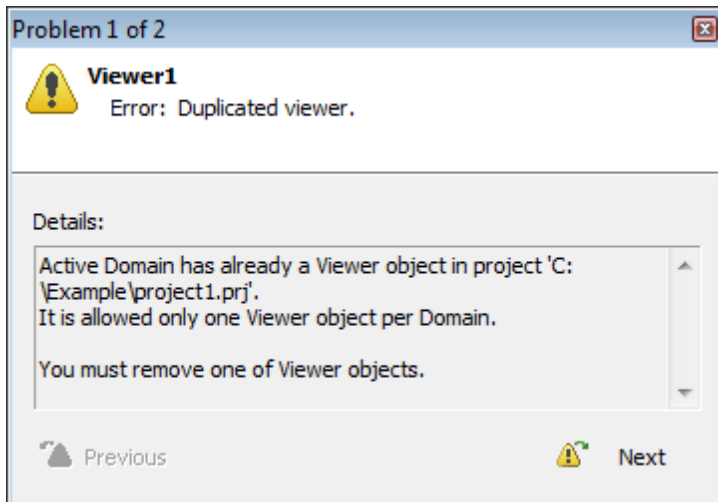
ICON	COMMAND	ACTION
	Align Left	Aligns objects to the left.
	Align Right	Aligns objects to the right.
	Align Top	Aligns objects to the top.
	Align Bottom	Aligns objects to the bottom.
	Same Width	Applies the same width to all objects.
	Same Height	Applies the same height to all objects.
	Same Size	Applies the same size to all selected objects.
	Center Horizontally	Centers objects horizontally.
	Center Vertically	Centers objects vertically.
	Space Across	Formats spacing between objects horizontally.
	Space Down	Formats spacing between objects vertically.
	Horizontal Flip	Applies a horizontal reflection to the selected object.
	Vertical Flip	Applies a vertical reflection to the selected object.
	Grid	Shows or hides the grid.

Available options for Formatting toolbar

ICON	COMMAND	ACTION
	Font	Determines text font.
	Font Size	Determines font size.
	Font Color	Determines font color.
	Bold	Format a text as bold.
	Italic	Formats a text as italic.
	Underlined	Formats a text as underline.
	Align Left	Aligns text to the left.
	Align Center	Aligns text to the center.
	Align Right	Aligns text to the right.

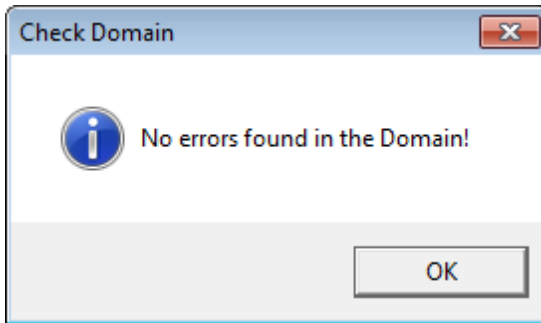
2.4.1 Check Domain

Checks for errors in the whole Domain, such as objects with the same name, illegal Links, etc. In case any error is found, E3 Studio opens the following dialog box with all errors found in a Domain.




Error check in a project

Until this error is solved, this dialog box remains on screen, and it is not possible to execute Viewer. After solving this problem, E3 Studio shows a message box indicating that there are no errors in this Domain, and Viewer execution is then allowed.



Message of item Check Domain

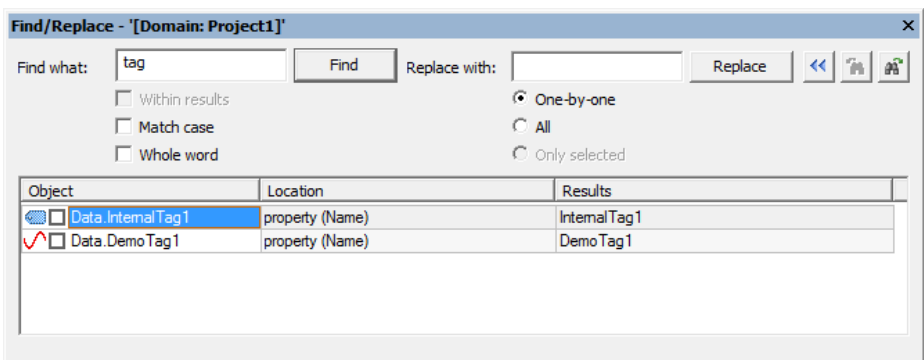
The **Check Domain** option can be accessed in the following ways:

- By using the  icon, available on Default toolbar: Checks for errors in the whole Domain
- By using the **Tools - Check Domain** menu: Same as the previous item
- By right-clicking a project item and selecting **Check** or **Check project**: Checks for errors only in the selected object and its child objects

2.4.2 Find and Replace

The **Find** tool searches for instances of a given text in a Domain, fully or partially. By the end of this search, users are presented to a list of results, indicating the object where this occurrence was found, its location inside that object (whether it is a property, a Link, etc.), and the text containing this occurrence.


The **Replace** tool replaces occurrences found by another specified text.



Find/Replace window



There are three ways to perform a find and replace operation:

- By selecting an item in Organizer, right-clicking it, and then selecting the **Find/Replace** option. This search is performed starting on this item, following its hierarchy (only child objects are searched)

- By clicking E3 Studio's **Tools - Find/Replace** menu. This search is performed on all open projects and libraries
- By clicking **Find/Replace** , on **Default** toolbar. This search is performed on the entire Domain

The available options are described on the next table.

Available options for Find/Search tool

OPTION	DESCRIPTION
Find what	Contains a text to search for.
Find	Starts searching for this text.
Within results	Starts searching again, only in the results of the previous search.
Match case	Searches for this text exactly as it was written, matching its case.
Whole word	Finds entire words only. Does not consider this text as a sub-string of another one.
Replace with	Contains a text to use as replacement.
Replace	Starts the replacement process.
One-by-one	Replaces the selected row and selects the next valid row.
All	Replaces all text instances at once.
Only selected	Replaces all instances selected on the results list at once.
◀ and ▶	Shows or hides find and replace options.
	Selects the previous occurrence on the results list.
	Selects the next occurrence on the results list.


NOTE: To select an object and show the exact position where this text is, double-click the results list, on the selected row.

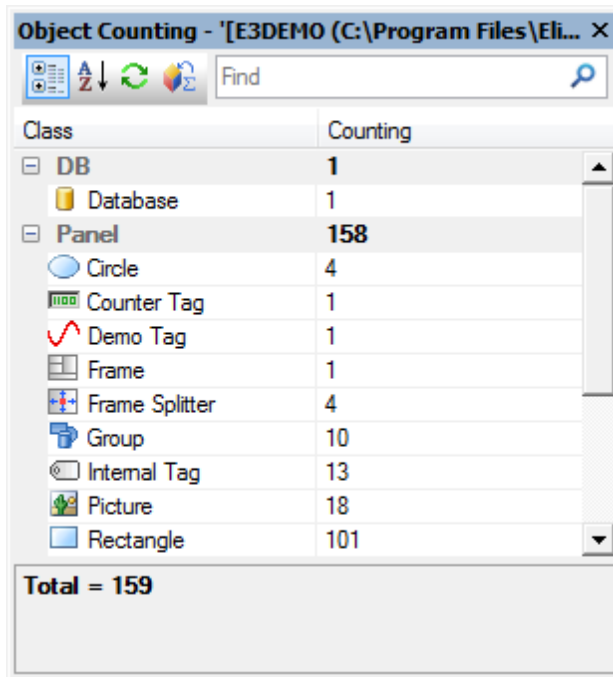
The following table contains all main search options, as well as limitations for main data types.

Main search options

DATA TYPE	EXAMPLE	NOTES
Date / Time	02/10/2010 00:00:10	Finds in Date/Time -type properties. If only a date is specified, finds all occurrences of that date, regardless of time. If only a time is specified, finds all occurrences of that time, regardless of date. Milliseconds are ignored during this search.
Integer	0 100	Finds in all number properties. Searching for 10 finds 10 and 10.0, but does not find 10.1 or 100.
Floating Point	10.0 40,5	Finds in all Floating Point -type number properties. Searching for 10.1 does not find 10 (integer). Windows regional settings are considered to validate a decimal symbol of a number.
Color	255,255,0 0,0,234	Finds only in Color -type properties. Users must use commas to separate values, which must comply with the RGB system.
Boolean	True False	Considers Windows language to process this search as a search for Boolean values.
String	Test Tag	Finds entire or partial Strings (according to search type, entire word or not). Any data type can be found on String -type properties.

2.4.3 Domain's Object Counting

Domain's Object Counting tool allows viewing the amount of existing objects in a Domain, separated by classes sorted alphabetically or grouped by modules. This counting can also be performed contextually to an object, by right-clicking an object and selecting the  **Object Counting** item.



Domain's Object Counting window

The available options on this window are described on the next table.

Available options on Domain's Object Counting window


ICON	OPTION	DESCRIPTION
	Sort by category	Displays object counting organized by module.
	Sort alphabetically	Displays object counting organized alphabetically.
	Refresh	Refreshes the object counting. NOTE: This refresh process is not automatic, except when a removed object is the base object of the counting context or when a Domain is closed.
	Count ElipseX's instance children	Includes in the counting internal children of XControl or XObject instances.
	Find	Allows filtering this list by object's name or partial name.

NOTES:

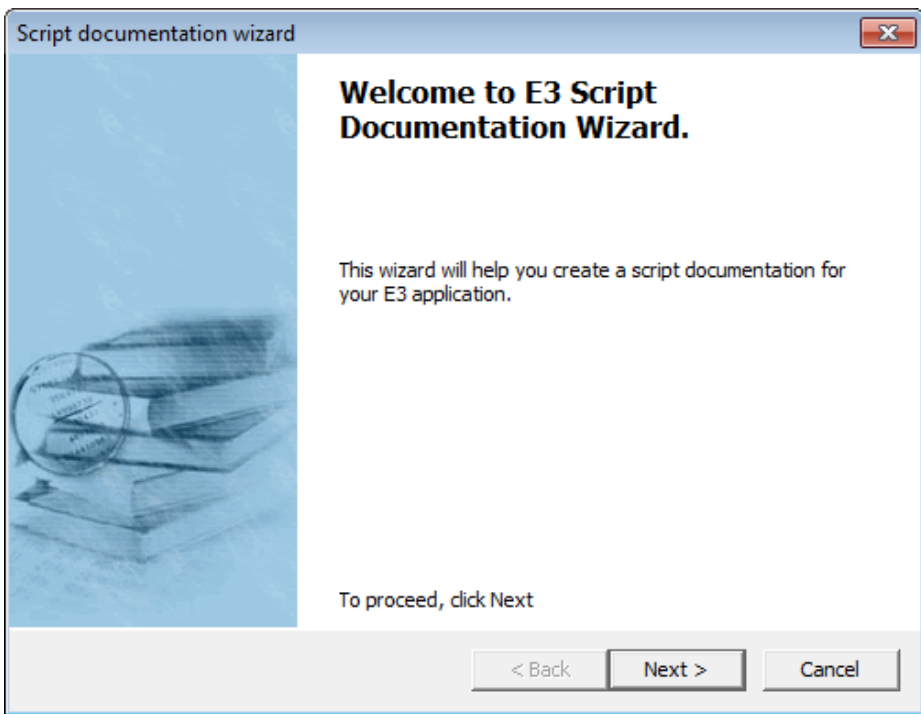
- The **Object Counting** contextual menu is not available in the Organizer in **Domain** mode for **Settings**, **Server objects**, **Files**, and **Remote Domains** items.
- Individual files on **Files** item in the Organizer in **Domain** mode allow using the **Object Counting** contextual menu.
- For password-protected files, they must be open to be added to this counting process.

2.4.4 Scripts Documentation

Scripts Documentation tool helps users to organize and document application's scripts. Users can access this tool in two different ways:

- By clicking  on **Default** toolbar. With this option, all Domain scripts are stored in a file
- By right-clicking project's or object's name, and selecting the **Document scripts** option. With this option, only this object and its child object scripts are stored in a file

This tool generates a text file that can be edited in any text editor. A documentation file is formatted with a wizard called **Script documentation Wizard**. This wizard helps users to configure a scripts documentation file.




Script documentation wizard

A Documentation file window defines information about a file that stores application scripts.

Type the name of a file where scripts documentation are generated in the **Filename** field. Specify a place where this file must be saved in the **Save file in folder** field, and, if necessary, click **Browse**.

Script documentation wizard

Documentation file
Type filename where documentation will be saved.

 Script documentation helps you organize your application scripts. A text file will be created with scripts, and you can edit it later with your favorite text editor.

In which file must this documentation be saved?

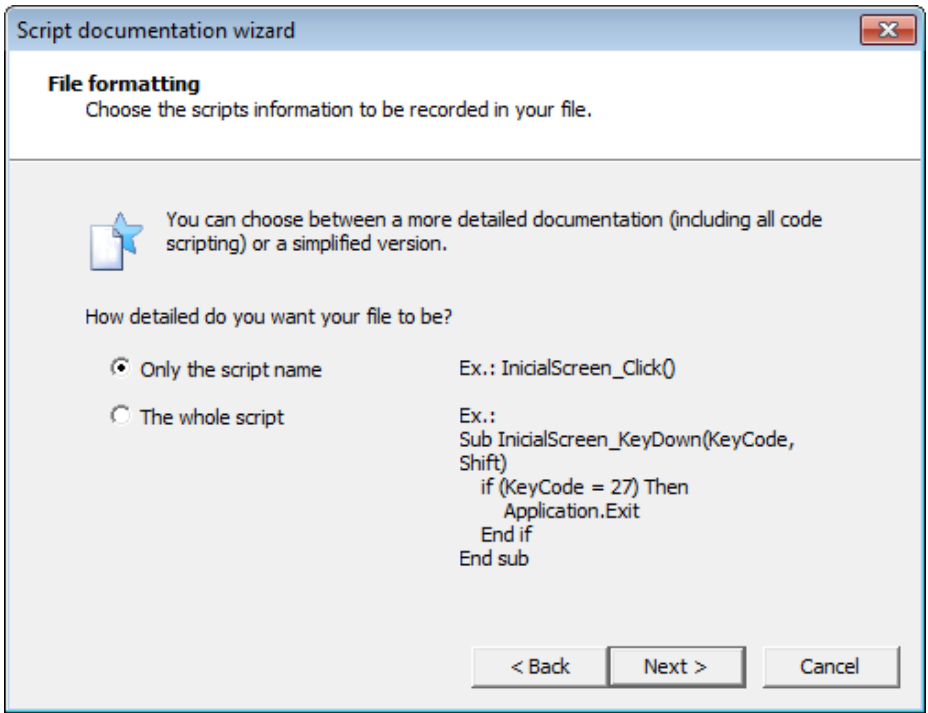
Filename:

Save file in folder:

Scripts documentation file

Click **Next**, and go to the next window.

The File formatting window allows users to format this file with script information. They can choose between a simplified documentation, containing only script names, or a complete documentation, containing the whole script code.



File formatting

For example, the following script:

```
Sub InitialScreen_KeyDown(KeyCode, Shift)
  If (KeyCode = 27) Then
    Application.Exit
  End Sub
```

If the selected option is **Only the script name**, the following text is stored in this file:

```
InitialScreen_KeyDown(KeyCode, Shift)
```

If, however, the selected option is **The whole script**, then this code is stored with the same user-defined format (indentation, blank lines, etc.) in Scripts editor.

Regardless of the chosen format, an identifier containing an object name is stored before saving this script, to avoid conflicts. For example, the following objects:

```
InitialScreen
  CommandButton1
Screen1
  CommandButton1
```

Both scripts (considering the same event, **Click**) would be **CommandButton1_Click()**. So, file recording would be:

```
<InitialScreen.CommandButton1:CommandButton1_Click()>
Sub CommandButton1_Click()
    ...
End Sub
```

And:

```
<Screen1.CommandButton1:CommandButton1_Click()>
Sub CommandButton1_Click()
    ...
End Sub
```

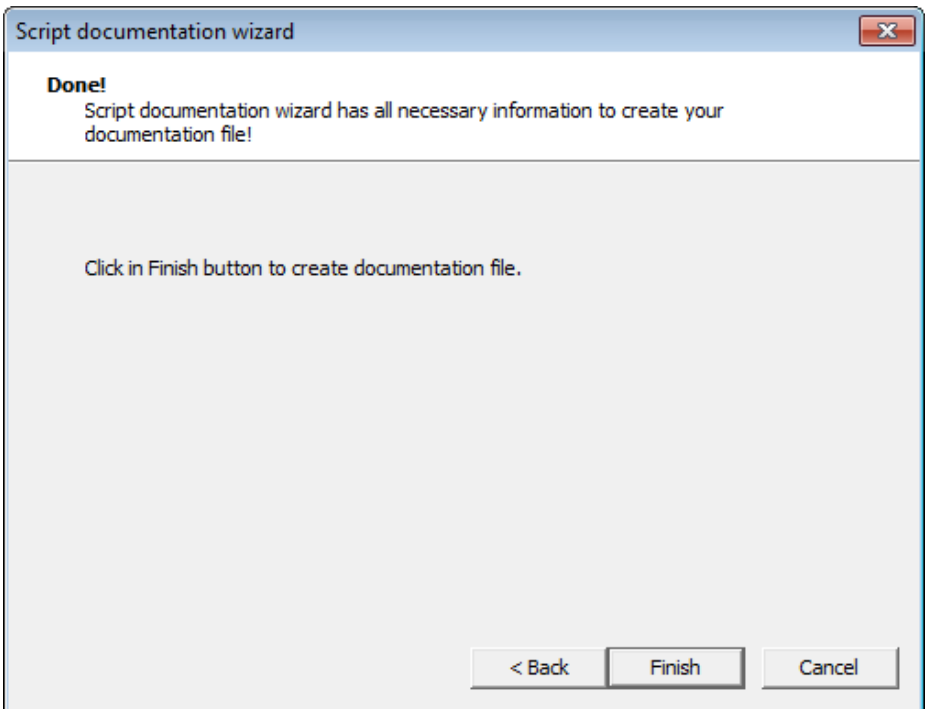
This allows correctly identifying each script. Click **Next** to go to the next window.

On the Scripts separator window, users can define a text that is stored between scripts in a documentation file. Users can choose between blank or customizable lines, and also inform how many of these lines are inserted into this file.

Scripts separator

Users can select a **Blank line** or a **Customizable line**. If they select the **Blank line** option, the documentation file has a blank line between each script. If they select the **Customizable line** option, then they can inform one or more characters to compose the line used as a script separator. These characters are informed in the **Type line text** field. If they select the **Repeat until the end of the line** option, the informed characters are repeated up to the line's size limit, which is 80 characters.

Users can also use more than one line as a separator, blank or customizable. Just inform a number between 1 and 100 in the **Type number of lines of separator** field. Click **Next** to finish the configuration. After that, this wizard shows a message indicating that both configuration and generation of the file containing scripts documentation are finished.



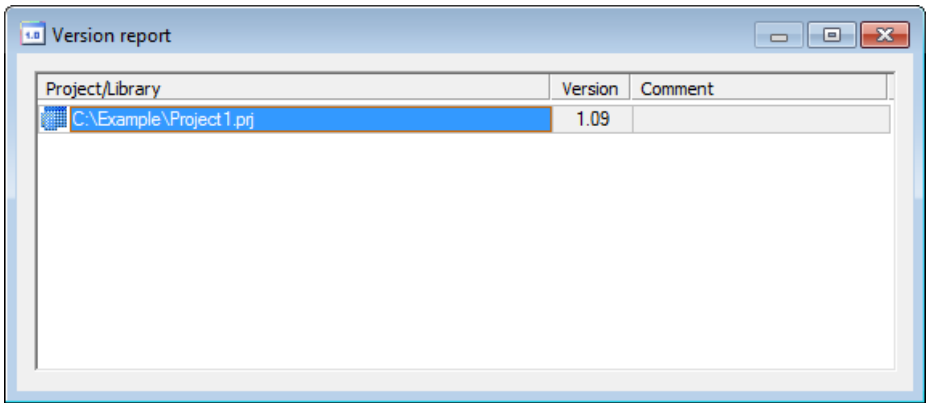
Final window to generate a file

Some relevant observations:

- XControl and XObject scripts are recorded only once in a file, because they are found during library search. Instance scripts are stored when an instance's parent object is searched
- Picks are internally scripts; therefore, they are also documented
- File storage is performed alphabetically per object name, inside every project or library
- It is not possible to add scripts to an existing file via Wizard. Every time this Wizard is started, a new file is created; in case it already exists, it is overwritten
- This tool may take a while to generate a documentation file, in case the application is too large and the search involves many types of objects. To improve a search, try generating a file for each E3's object type

2.4.5 Version Report

Version Report tool enables viewing versions and comments of open projects and libraries, whether they belong to a Domain or not. To access this tool, click **1.0** on **Default** toolbar to display the window on the next figure.



Version Report


The available options are described on the next table.

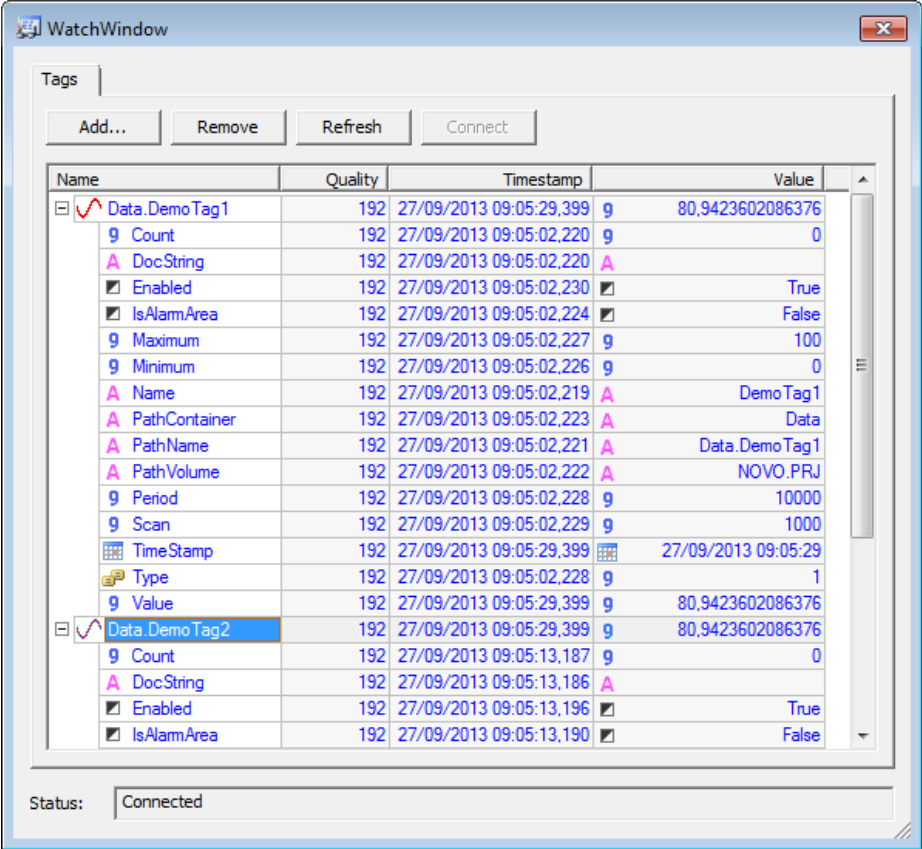
Available options for Version Report dialog box

OPTION	DESCRIPTION
Project/Library	Name of an open project or library in a Domain.
Version	Indicates a project or library version. This version is generated internally by E3 and it is incremented every time a project is saved, either manually or automatically. In case of protected projects and libraries, if this version cannot be saved, it is not possible to increment it either. However, if users have permission to open and change a project or library, this version is incremented normally.
Comment	Shows a project-related comment. This comment can be edited via DocString property. In case of libraries, this field is blank.

NOTE: These fields are strictly for viewing, therefore their edition is not allowed.

2.4.6 WatchWindow

WatchWindow tool allows viewing the current value of any property or Tag at run time in E3 Studio. To use this tool, click  on **Default** toolbar or go to the **Tools - WatchWindow** menu to display the dialog box on the next figure.



WatchWindow dialog box

Options on this dialog box are described on the next table.

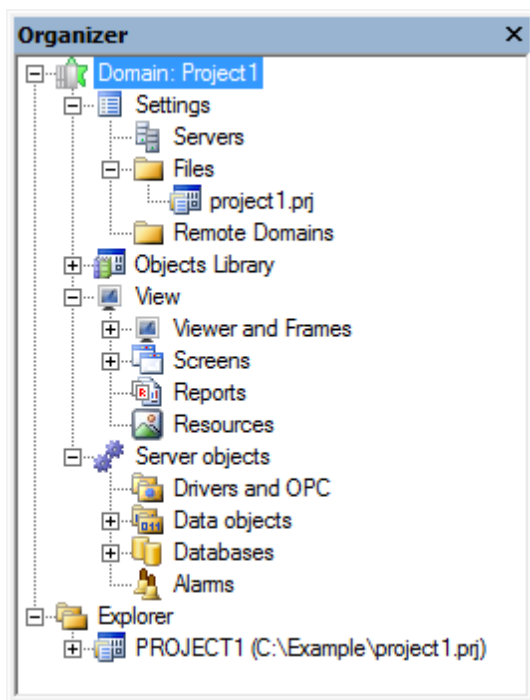
Available options for WatchWindow dialog box

OPTION	DESCRIPTION
Add	Opens a DomainBrowser (an AppBrowser containing objects created on a server) and selects an object to display on WatchWindow.
Remove	Removes the selected row from WatchWindow's objects list.

OPTION	DESCRIPTION
Refresh	Searches for the whole child tree of currently selected objects on WatchWindow.
Connect	Tries to reactivate a lost connection with a Domain, to enable viewing it.
Name	Displays a Tag or property being viewed.
Quality	Displays the quality of a Tag or property.
Timestamp	Displays the timestamp of a Tag or property.
Value	Displays the value of a Tag or property, at run time.
Status	Displays whether a Domain is connected or not.

2.5 Organizer

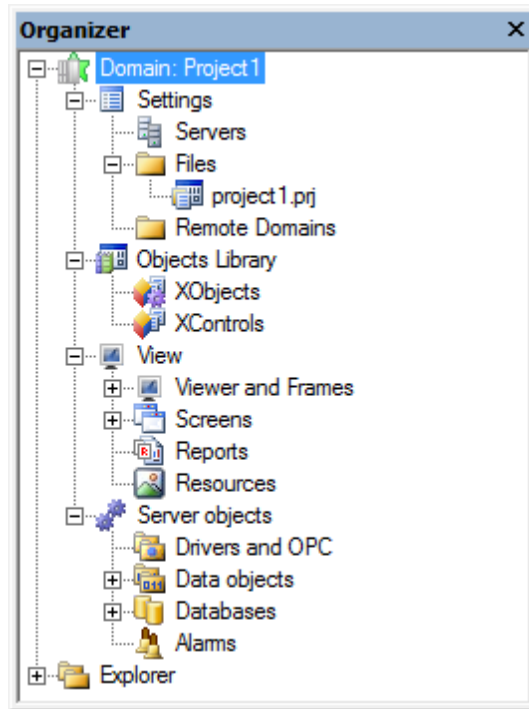
The **Organizer** allows users to view an application as a whole, in a simple and organized way. It helps editing and configuring all objects involved, by using a hierarchical options tree. It has two viewing modes, **Domain** and **Explorer**.



Organizer

The **Domain** mode shows only information about open objects belonging to a Domain. This information is divided into four groups: **Settings**, **Objects Library**, **View**, and **Server Objects**. Each group presents its objects sorted out alphabetically

inside its respective node.



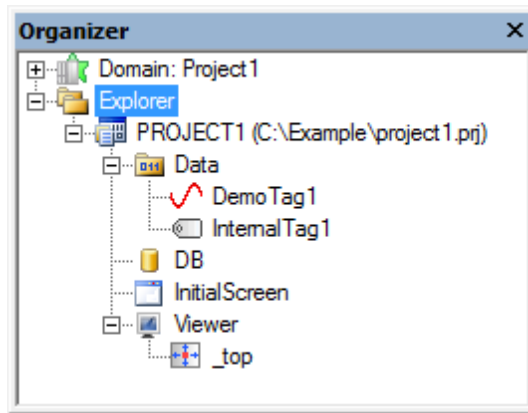
Domain mode

The **Settings** group shows all configured servers, as well as names of project and library files belonging to a Domain.

The **Objects Library** group collects ElipseX objects from all libraries in a Domain, sorted out by type (**XObjects** and **XControls**).

The remaining E3 objects are in **View** or **Server Objects** groups. **View** contains objects running in the client machine. Objects running in the server machine are in **Server Objects**.

The **Explorer** mode shows all projects and libraries currently open in E3 Studio, whether they belong to a Domain or not. These objects are shown inside the project or library they belong to, sorted out alphabetically.



Explorer mode


Application maintenance can be handled in both modes. Operations performed in one mode are immediately reflected in the other mode. To make it easier to locate all objects, both modes are interchangeable between each other and between the **Design** tab in the object's view. To alternate between viewing modes, follow these procedures:

1. In **Domain** mode, right-click an object and select **Show in Explorer** to view it in **Explorer** mode.
2. In **Explorer** mode, right-click an object and select **Show in Organizer** to view it in **Domain** mode.
3. In either mode, right-click an object and select **Show in Editor** to view it on **Design** tab.
4. In any object's view, on **Design** tab, right-click an object and select **Show in Organizer** or **Show in Explorer** to view it in Organizer, in its respective mode.

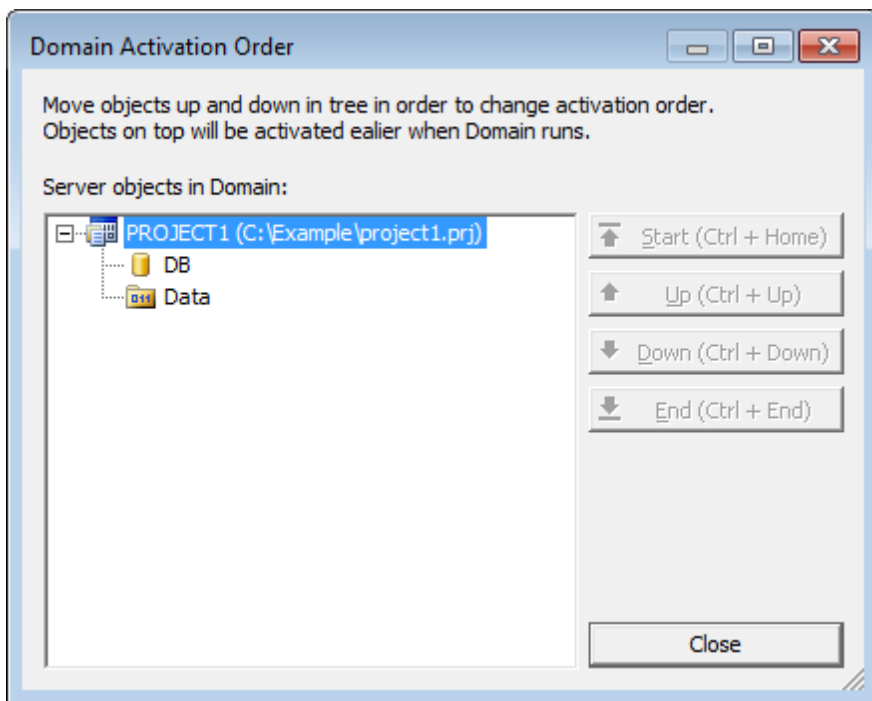
When left-clicking an object, its properties can be viewed and edited in the Properties List, if enabled. By right-clicking an item in Organizer, the options on the next table are displayed.

Available options in the Organizer

OPTION	DESCRIPTION
Close	Closes the current project or library.
Refresh	Updates project or library settings.
Register	Registers an library, so that updates become available.
Save As	Opens a dialog box to save a project to the indicated location.

OPTION	DESCRIPTION
Defragment	Defragments files (.lib or .prj), that is, removes unnecessary spaces (by excluding items, importing files, including resources, etc.). After defragmentation, a window is displayed with the following information: file's original size, file's defragmented size, and compression's percentage.
Protection	Protects the content of a .prj or .lib file against unauthorized edition, viewing, or execution. For further information on this option, please check the Security chapter.
New Folder	Creates a new Folder in an application.
Insert	Inserts objects available in E3 into a project or library. For further information on this option, please check each object's respective chapter.
Insert Resource	Inserts resources into a project or library.
Enable/Disable project	Enables or disables the selected project. To disable it, select its name and select Disable project . Notice that project's icon changes to  , indicating that it is disabled. To enable it, select its name and then the Enable project option.
Add/Remove from Domain	Adds or removes a project or library from a Domain. To remove it, select its name and select Remove from Domain . To add it, select its name and then the Add to the Domain option.
Find/Replace	Searches for parts of a text in a project and replace them with others, if necessary. For further information on this option, please check topic Find and Replace in this chapter.
Object Counting	Displays the amount of existing objects in a Domain or in the selected object. This option is not available for Settings , Server objects , Files , and Remote Domains items.
Import/Export	Helps users to import and export objects, Links, and collections. For further information on this option, please check topic Import/Export in this chapter.
Document Scripts	Helps users with application's scripts documentation. For further information on this option, please check topic Scripts Documentation in this chapter.
Check	Checks for errors in an application. For further information on this option, please check topic Check Domain in this chapter.

OPTION	DESCRIPTION
Edit Links	Changes one or more Links, user events, and Link -type properties in an application, quicker than using the Properties List window. For further information on this option, please check the Links chapter.
Copy/Paste Links	Copies or pastes Links from one object to another. The second option is only displayed if what was copied to the Clipboard is a Link. If the selected property already has a Link, it is then displayed a message asking whether this Link should be overwritten. If Links copied to the Clipboard are pasted into an object that does not have one of these properties, they are listed in a message box informing this problem. The existing properties have their Links created correctly. Links from ElipseX's hidden properties are not copied.
Properties	Opens an object's Properties List window. When this option is selected on a menu, the first tab to be opened is object's settings tab. For further information on this option, please check each object's respective chapter.
Load All Objects	Loads all objects from the selected group.
Close All Objects	Closes all objects from the selected group.
Save All Objects	Saves all objects from the selected group.
New Application File (.PRJ)	Creates a new .prj file and adds it to a Domain.
New Objects Library (.LIB)	Creates a new .lib file and adds it to a Domain.
Register loaded libraries	Registers all libraries.
Open All Files	Traverses all .prj and .lib files in a Domain. If a closed file is found, it is then opened. If a file is protected by an edition password, this password is then asked. E3 Studio tries to use the same password for all protected files. If this password fails for any of these files, it is then asked again.
Close All Files	Closes all .prj and .lib files in a Domain. If any file has unsaved changes, E3 Studio then displays a message asking users whether they want to save them.
Edit Domain activation order	Allows changing the activation order of Server objects in a Domain (please check the next figure).



Domain's Activation Order

2.6 Import and Export

The import tool in E3 reads information about objects from a **CSV** (*Comma Separated Values*) file, and recreates them in the configuration environment (E3 Studio). For each object, users can get information on properties, Links, and collection items.

The export tool in E3 stores information about selected objects from the configuration environment (E3 Studio) into a CSV file. For each object, users can store its properties, Links, and collection items. Therefore, it is possible to:

- Create new E3 objects from a CSV file, as long as these objects are not direct child objects of the project or library
- Import or export any property from any type of E3 object
- Import or export any type of Link from E3 objects
- Export any type of E3's objects collection and import their properties
- Import or export any type of item from E3's objects collection

Any E3 object can be imported or exported. The selected object for this operation is called the root object. So, users can import or export a Data Folder with user-defined XObjects, for example, or even export a Screen, listing all its child objects.

In addition to objects, Links and collections can also be imported and exported. Users have the option to inform whether they want to import or export Links and collections.

NOTE: The import and export tool only considers properties and Links from E3 objects and collections. Information not described in properties are not imported or exported. That is, for example, the case of scripts and internal settings of Screen objects.

2.6.1 CSV File

A **CSV** (*Comma Separated Values*) file is a text file based on comma-separated columns, or on any other previously defined separator. In E3, these files have information about objects that were exported, and are used in the import process to create these objects properly in E3 Studio. Each column in a CSV file stands for one or more properties of an E3 object, and each row stands for an object, Link, or collection item. To ensure that these files are used correctly, users must pay attention to some details:

- The first row in a CSV file must contain a header identifying all columns correctly
- This header must necessarily contain a column identifying the type of object being imported or exported. This column's name is **ObjectType**. Its value is the name of an object's class (**XObject1**, **DrawRect**, **InternalTag**, **AgSimple**, etc.), except for collections, which display pre-defined keywords (**ITableBindRow**, **IAxis**, etc.)
- The header for the next columns must be the name of the property itself
- Columns can be placed in any order in a file; there can be more or less columns, without interfering in the import or export process. The only mandatory column is **ObjectType**, because without this column it is impossible to identify the type of object to create

2.6.1.1 Generating a CSV File Manually

Users can generate a CSV file using Notepad, Excel, or any other Windows application. The generated file uses the separator configured in Windows (based on the user configuration, not the system configuration).

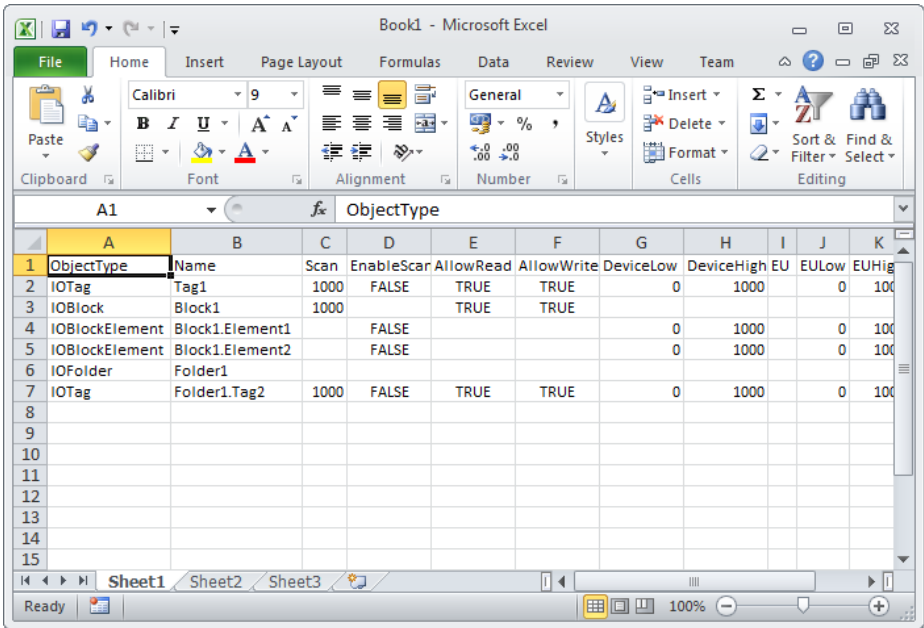
The first row in the file must contain a header with column names. Each column must be a property or an identifier defined in the template, as seen next. Objects must be placed on rows, and property values on the corresponding columns. Not all object properties should be listed on the header, nor should all columns be

necessarily linked to properties of a given object.

It is also important that the CSV file have a column for the **Name** property. Without it, it is not possible to determine where exactly the object must be generated. Names display the object's correct hierarchy, and names with special characters must be surrounded by brackets.

Next, there is an example of a CSV file, which can be manually created in Excel.

1. Open Excel and set the header with the following fields, one for each column, according to the following figure.



The screenshot shows the Microsoft Excel interface with a spreadsheet titled 'Book1 - Microsoft Excel'. The spreadsheet has columns labeled A through K. The first row (row 1) contains the following headers: 'ObjectType', 'Name', 'Scan', 'EnableScan', 'AllowRead', 'AllowWrite', 'DeviceLow', 'DeviceHigh', 'EU', 'EULow', and 'EUHigh'. The second row (row 2) contains the following data: 'IOTag', 'Tag1', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The third row (row 3) contains the following data: 'IOBlock', 'Block1', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The fourth row (row 4) contains the following data: 'IOBlockElement', 'Block1.Element1', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The fifth row (row 5) contains the following data: 'IOBlockElement', 'Block1.Element2', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The sixth row (row 6) contains the following data: 'IOFolder', 'Folder1', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The seventh row (row 7) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The eighth row (row 8) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The ninth row (row 9) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The tenth row (row 10) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The eleventh row (row 11) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The twelfth row (row 12) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The thirteenth row (row 13) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The fourteenth row (row 14) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The fifteenth row (row 15) contains the following data: 'IOTag', 'Folder1.Tag2', '1000', 'FALSE', 'TRUE', 'TRUE', '0', '1000', '0', '1000', and '1000'. The bottom of the Excel window shows the 'Ready' status bar and the 'Sheet1' tab selected.

	A	B	C	D	E	F	G	H	I	J	K
1	ObjectType	Name	Scan	EnableScan	AllowRead	AllowWrite	DeviceLow	DeviceHigh	EU	EULow	EUHigh
2	IOTag	Tag1	1000	FALSE	TRUE	TRUE	0	1000		0	1000
3	IOBlock	Block1	1000		TRUE	TRUE					
4	IOBlockElement	Block1.Element1		FALSE			0	1000		0	1000
5	IOBlockElement	Block1.Element2		FALSE			0	1000		0	1000
6	IOFolder	Folder1									
7	IOTag	Folder1.Tag2	1000	FALSE	TRUE	TRUE	0	1000		0	1000
8											
9											
10											
11											
12											
13											
14											
15											

A CSV file viewed in Excel

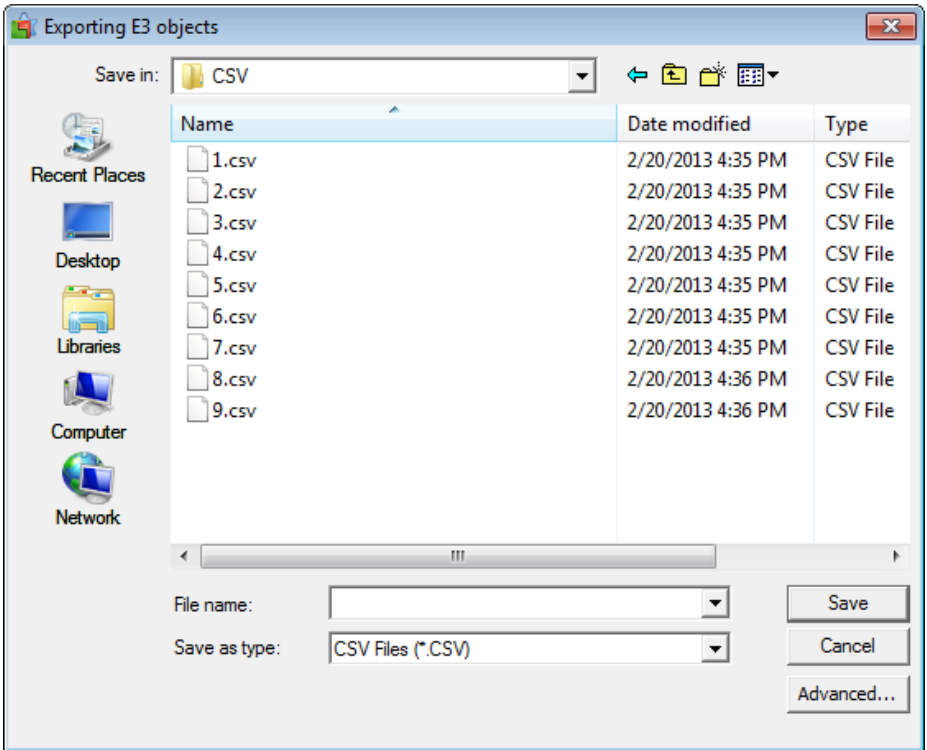
2. Save the spreadsheet with a .csv extension.
3. Close the file in Excel.
4. To import this file in E3, select an IODriver object and import the generated file using the **Import** option, choosing the appropriate template. E3 will then create the structure according to the CSV file.

2.6.2 Objects

Importing and exporting objects in E3 can be performed for any type of object, except for projects and libraries. An operation starting at a root object is performed on its properties and child objects. To export objects, follow these procedures:

1. Right-click an object and select **Export**.

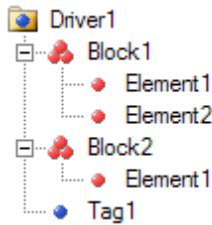
2. On the dialog box, select a CSV file and click **Save**.



Exporting an object

During the export procedure, all properties, Links, collections, and collection items from the selected object and from its children are automatically exported. A CSV file is then generated with one row for each exported object, as well as for each Link, collection, or collection item available on these objects. For each property, a column is created on a file, where it is informed the value of that property for each object.

The selected object, called a root object, is exported with the **Name** property's column blank. For all other cases, this column contains a hierarchy with names separated by dots. An example of an export process starting at an IODriver object:



**Hierarchy of object
Driver1**

```

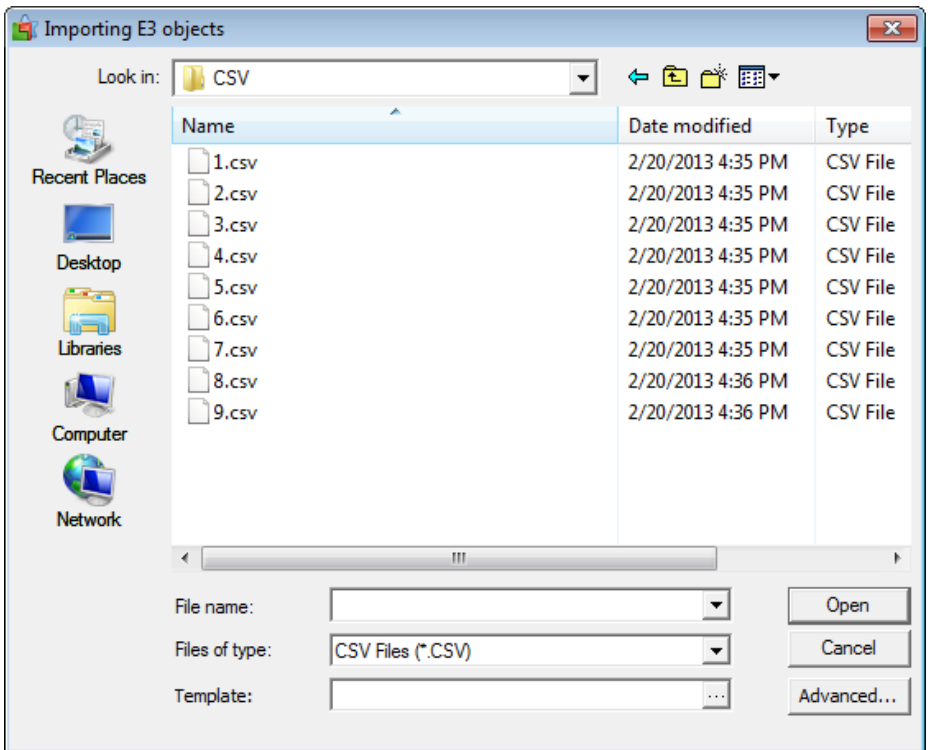
ObjectType;Name;Prop1;Prop2;Prop3
IODriver;;0;True;0
IOBlock;Block1;0;False;0
IOBlockElement;Block1.Element1;0;False;0
IOBlockElement;Block1.Element2;0;False;0
IOBlock;Block2;0;False;0
IOBlockElement;Block2.Element1;0;False;0
IOTag;Tag1,0,True,0
  
```

If needed, users can configure object export using templates, which are presented on topic **Templates**. When using a template, it is possible to configure whether Links, collections, and collection items are exported or not, whether a root object is exported or not, and which properties of each object must be exported, among other configurations. To do so, follow these procedures:

1. Right-click an object and select **Export**.
2. Click **Advanced** to configure or select a template.
3. On the dialog box, select a CSV file and then click **Save**.

To import objects, follow these procedures:

1. Right-click an object and select **Import**.
2. On the dialog box, select a CSV file and then click **Open**.



Importing objects

When importing, for each row read from a CSV file, there is an identification of an object to create. Only the child at the end of the hierarchy can be created. The remaining path must already exist. For example, in an object **Folder1.Folder2.Tag**, only **Tag** can be created. **Folder1** and **Folder2** must exist previously. So, it is allowed to have only folders on a file, without children. This file may have rows such as these ones:

```
ObjectType;Name
IOFolder;Folder1
```

Blank rows, rows where no valid identifier is found, blank columns, and columns with invalid property names are ignored, without generating an error.

2.6.3 Templates

Templates are INI files used to configure both import and export tools. They inform, for example, which type of separator is used in a CSV file, whether object Links should be exported, etc. INI files have the following format:

- Rows starting with a semicolon are comments, and are not considered when interpreting a file

- This file is organized in sections, and each section contains one or more variables. Sections are identified by names inside brackets. Variables are all words before an equal sign. A section cannot contain two variables with the same name
- Blank rows are ignored

An example of an INI file is displayed next:

```
; First section
[SECTION1]
Var1=0
Var2=1
; Second section
[SECTION2]
Var1=TRUE
Var3=FALSE
```

This format is a text that can be easily altered by users, and they can generate a new template by using a regular text editor. The same template can be used both for importing and exporting objects.

E3 templates allow users to redefine values for columns in a CSV file, as well as for object types. In addition, they also allow users to group more than one property in the same column. This is all performed by defining identifiers, which are keywords used in a CSV file, and linked to properties or object classes in an INI file.

In E3, these templates for this import and export tool are defined with the following sections and variables:

Sections defined for Templates

SECTION	DESCRIPTION
Header (*)	Defines the identifiers allowed for column names and data types. This section must define the header and types variables. (*) Mandatory section for export.
Configuration	Defines additional configurations for this import or export tool. This section must define the separator , root , link , collection , objectduplicated , and bindduplicated variables.
Types	Creates a relationship between data type identifiers and real object classes. Each identifier listed on the types variable that is not equal to an object's class name must be documented in this section, and a variable must be created for each identifier.

SECTION	DESCRIPTION
Columns	Creates a relationship between column name identifiers and property names. Each identifier listed on the header variable that is not equal to a property name must be documented in this section, and a variable must be created for each identifier.
Filter	Defines which object classes must be imported or exported. This section must define one of these two variables: include or exclude . If both are defined, only include is considered.

Variables defined for Templates

SECTION	DESCRIPTION
header (*)	Defines a column order and identifiers to use. All columns of a CSV file must be listed, separated by commas. Each identifier that is not equal to a property name must be listed in section Columns , each one with a variable. (*) Mandatory variable for export.
types	Defines identifiers for allowed data types in a CSV file. These identifiers must be listed in this variable, separated by commas. It is only necessary to define this variable if there is an identifier that is different from an object's class name. In this case, for each identifier, there must also have a variable in section Types .
separator	Defines a separator to use for delimiting columns in a CSV file. In case this variable is not defined, a list separator configured in Windows is used.
root	Defines whether a root object is exported or imported, along with its child objects. In case this variable is not defined, a root object is used.
link	Defines whether object Links are exported or imported. In case this variable is not defined, Links are used.
collection	Defines whether object collections are exported or imported. In case this variable is not defined, collections are used.

SECTION	DESCRIPTION
objectduplicated	<p>Defines what to do when a pre-existing object is imported. Possible values for this variable are:</p> <ul style="list-style-type: none"> • 0 - askalways: Always asks what to do • 1 - changealways: Always changes all properties of the existing object • 2 - ignorealways: Always ignores the object being imported • 3 - createalways: Always creates a new object, auto-incrementing its name <p>In case this variable is not defined, the askalways value is then applied. This option is not used in the export process.</p>
bindduplicated	<p>Defines what to do when a pre-existing Link is imported. Possible values for this variable are:</p> <ul style="list-style-type: none"> • 0 - askalways: Always asks what to do • 1 - changealways: Always replaces the existing Link by a new one • 2 - ignorealways: Always ignores the Link being imported <p>In case this variable is not defined, the askalways value is then applied. This option is not used in the export process, nor does it have the createalways value. If used, it is always changed to askalways.</p>
collectionduplicated	<p>Defines what to do when a pre-existing collection is being imported. Possible values for this variable are:</p> <ul style="list-style-type: none"> • 0 - askalways: Always asks what to do • 1 - changealways: Always replaces the existing collection by a new one • 2 - ignorealways: Always ignores the collection being imported <p>In case this variable is not defined, the askalways value is then applied. This option is not used in the export process, nor does it have the createalways value. If used, it is always changed to askalways.</p>

SECTION	DESCRIPTION
itemduplicated	<p>Defines what to do when a pre-existing collection item is being imported. Possible values for this variable are:</p> <ul style="list-style-type: none"> • 0 - askalways: Always asks what to do • 1 - changealways: Always changes all properties of the existing item • 2 - ignorealways: Always ignores the item being imported • 3 - createalways: Always creates a new item, auto-incrementing its name <p>In case this variable is not defined, the askalways value is then applied. This option is not used in the export process.</p>
include	<p>Defines which object classes must be imported or exported. This filter is not recursive, that is, if an object class that may have child objects is included, these child objects are not automatically included. It cannot be used along with the exclude variable. Only what is defined in this variable can be imported or exported.</p>
exclude	<p>Defines which object classes must not be imported or exported. This filter is not recursive, that is, if an object class that may have child objects is excluded, these child objects are not automatically excluded. It cannot be used along with the include variable. Only what is defined in this variable can be imported or exported.</p>

NOTE: A semicolon character cannot be used as a full or partial name of a column, neither can it be used as a full or partial name for an identifier. This limitation is due to the fact that a semicolon defines a comment in an INI file. Thus, a variable created in either **Columns** or **Types** section to define an identifier that has a semicolon cannot be read correctly.

Example:

```
[Header]
header=ObjectType,Name,DocString,N1/B1,N2/B2,
N3/B3,N4/B4,Scan,AllowRead,AllowWrite
types=Tag,Block,Element

[Configuration]
separator=', '
root=true
link=true
collection=true
```

```
objectduplicated=askalways  
bindduplicated=askalways  
collectionduplicated=askalways  
itemduplicated=askalways  
  
[Types]  
Tag=IOTag  
Block=IOBlock  
Element=IOBlockElement  
  
[Columns]  
N1/B1=N1,B1  
N2/B2=N2,B2  
N3/B3=N3,B3  
N4/B4=N4,B4  
  
[Filter]  
exclude=IOFolder
```

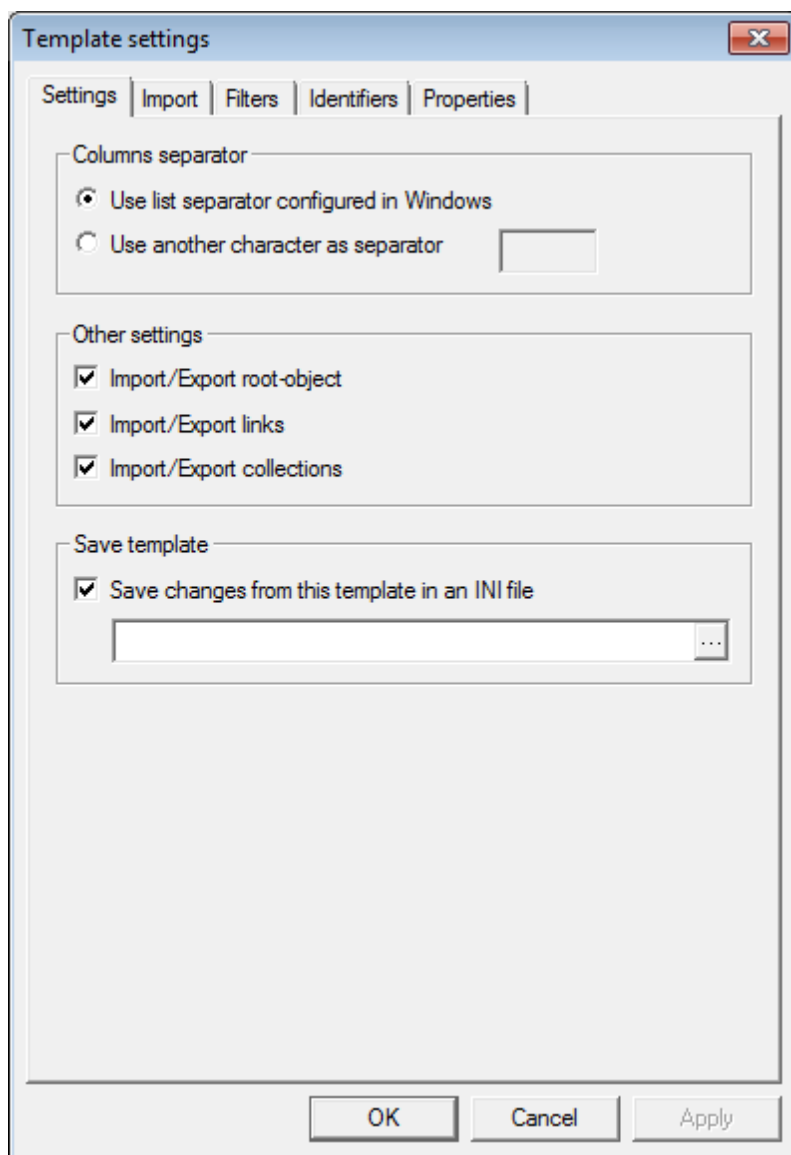
Eclipse Software provides some templates for importing or exporting different object types. These templates can also be used as a basis to create others. Templates are on folder **Templates** of E3's installation path.

NOTE: On the import process, columns to use are read directly from a CSV file. On this particular case, there is no need for a **header** variable on a template. However, if any column is named using an identifier, this one must be defined on **Columns** section or this column is ignored.

2.6.4 Template Settings

The **Template Settings** is a tool that helps users to create an INI file to be used when importing or exporting E3 objects. To access it, click **Import/Export** and, once this option's window is opened, click **Advanced**. If users already loaded a template, values of initial options on these tabs reflect that configuration. The available tabs are described next.

- **Settings:** On this tab, users can configure valid options for the import process as well as for the export process



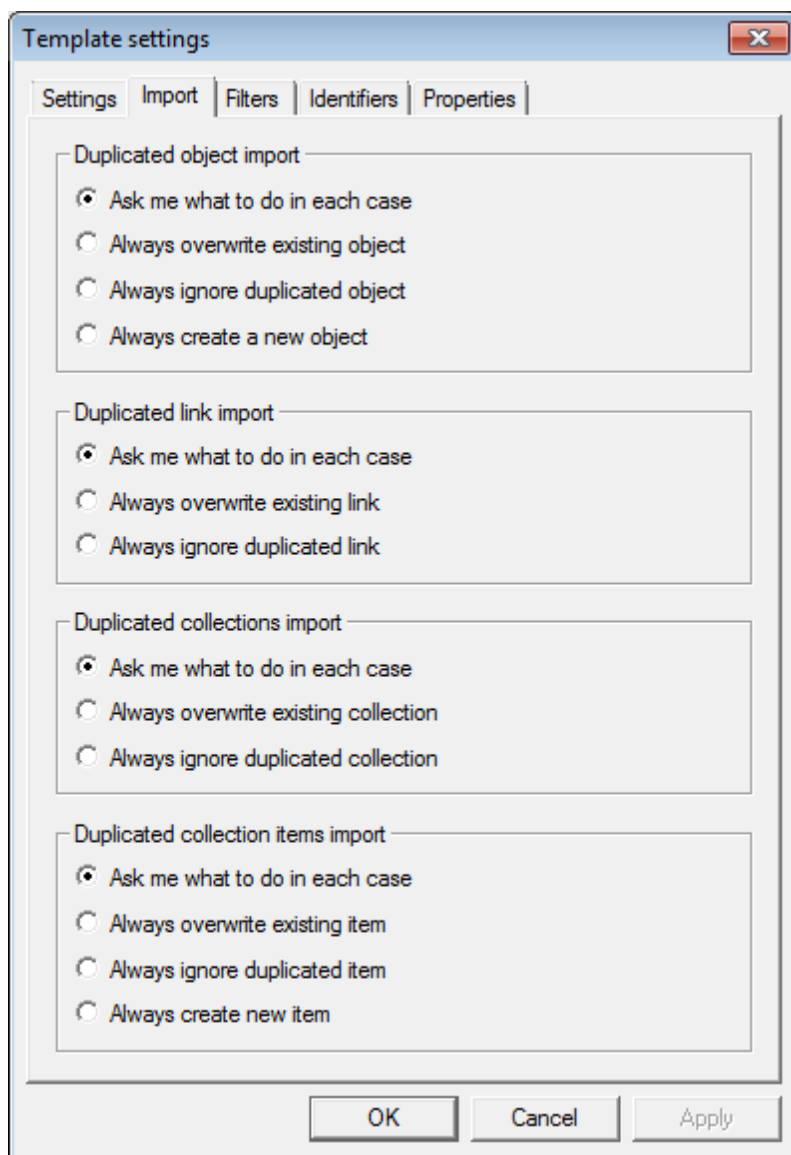
Settings tab

The available options on this tab are described on the next table.

Available options for Settings tab

OPTION	DESCRIPTION
Columns separator	The available options are: Use list separator configured in Windows (selects the character configured on Windows as the list separator to use as CSV file's column separator) and Use another character as separator (let users select another character as the column separator).
Other settings	Defines what is imported or exported: objects, Links, or collections. The available options are: Import/Export root object , Import/Export Links , or Import/Export collections .
Save template	When the Save changes from this template in an INI file option is selected, it defines an INI file where changes to this template are saved, and this file can then be used again. When this option is not selected, changes made to this template are temporarily saved to a file on Windows temporary folder. This file is used to perform an import or export process right after configuration, and it is removed later.

- **Import:** On this tab, users can configure import-only options



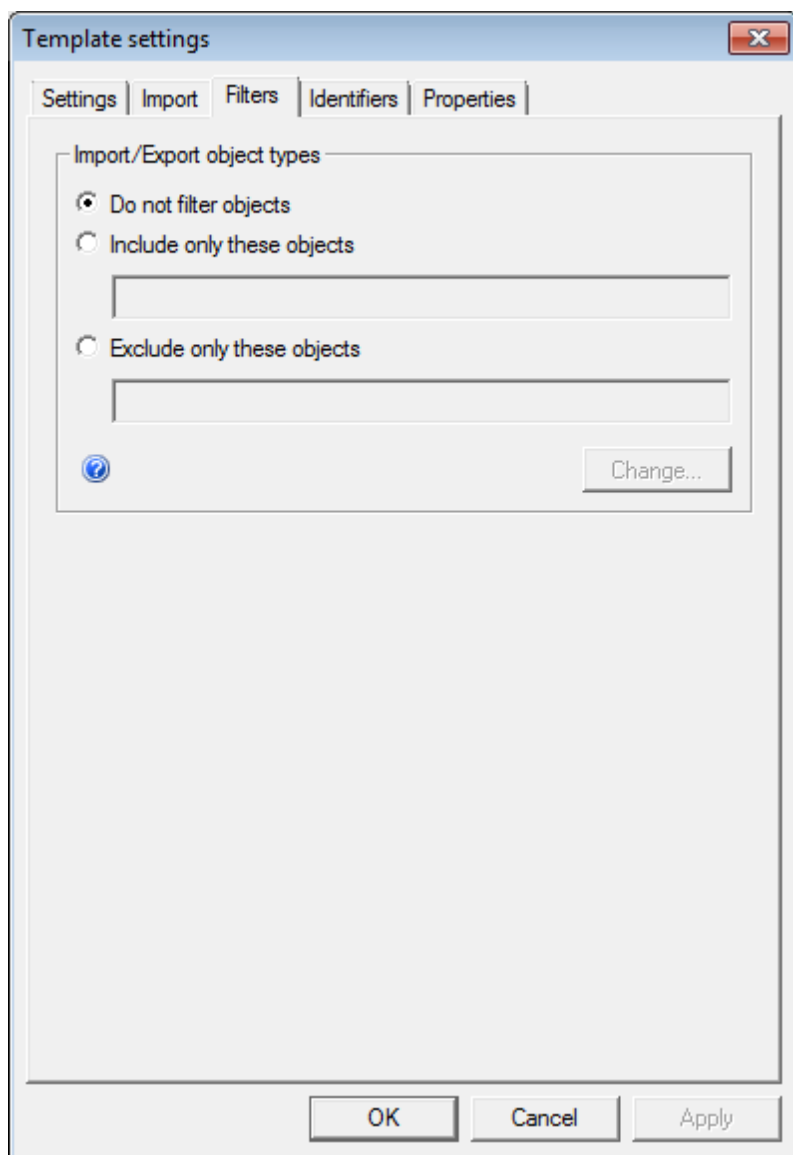
Import tab

The available options on this tab are described on the next table.

Available options for Import tab

OPTION	DESCRIPTION
Duplicated object import	Specifies how E3 must handle the occurrence of duplicated objects during the import process. The available options are Ask me what to do in each case , Always overwrite existing object , Always ignore duplicated object , or Always create a new object .
Duplicated link import	Specifies how E3 must handle the occurrence of duplicated Links during the import process. The available options are Ask me what to do in each case , Always overwrite existing Link , or Always ignore duplicated Link .
Duplicated collections import	Specifies how E3 must handle the occurrence of duplicated collections during the import process. The available options are Ask me what to do in each case , Always overwrite existing collection , or Always ignore duplicated collection .
Duplicated collection items import	Specifies how E3 must handle the occurrence of duplicated collection items during the import process. The available options are Ask me what to do in each case , Always overwrite existing item , Always ignore duplicated item , or Always create a new item .

- **Filters:** On this tab, users can select classes to use in the import or export process, or which classes not to use




Filters tab

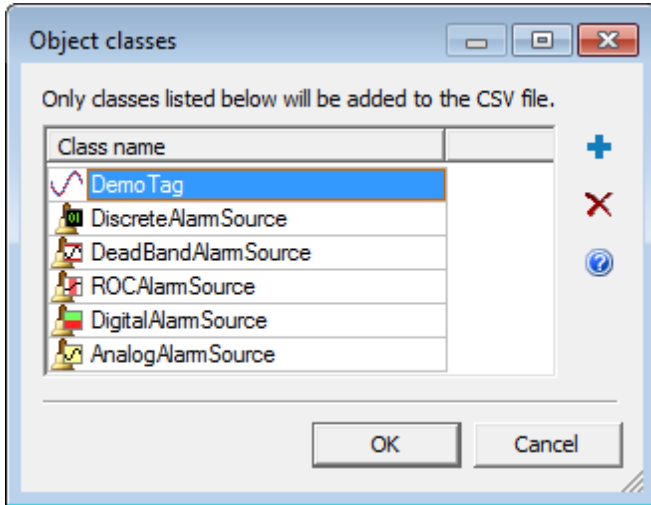
The available options on this tab are described on the next table.

Available options for Filters tab



OPTION	DESCRIPTION
Do not filter objects	Defines that all objects are imported or exported.

OPTION	DESCRIPTION
Include only these objects	Defines which object classes are imported or exported.
Exclude only these objects	Defines which object classes are not imported or exported.
Change	Opens a window for selecting object classes to include or to exclude.
	Opens a help window for this option.

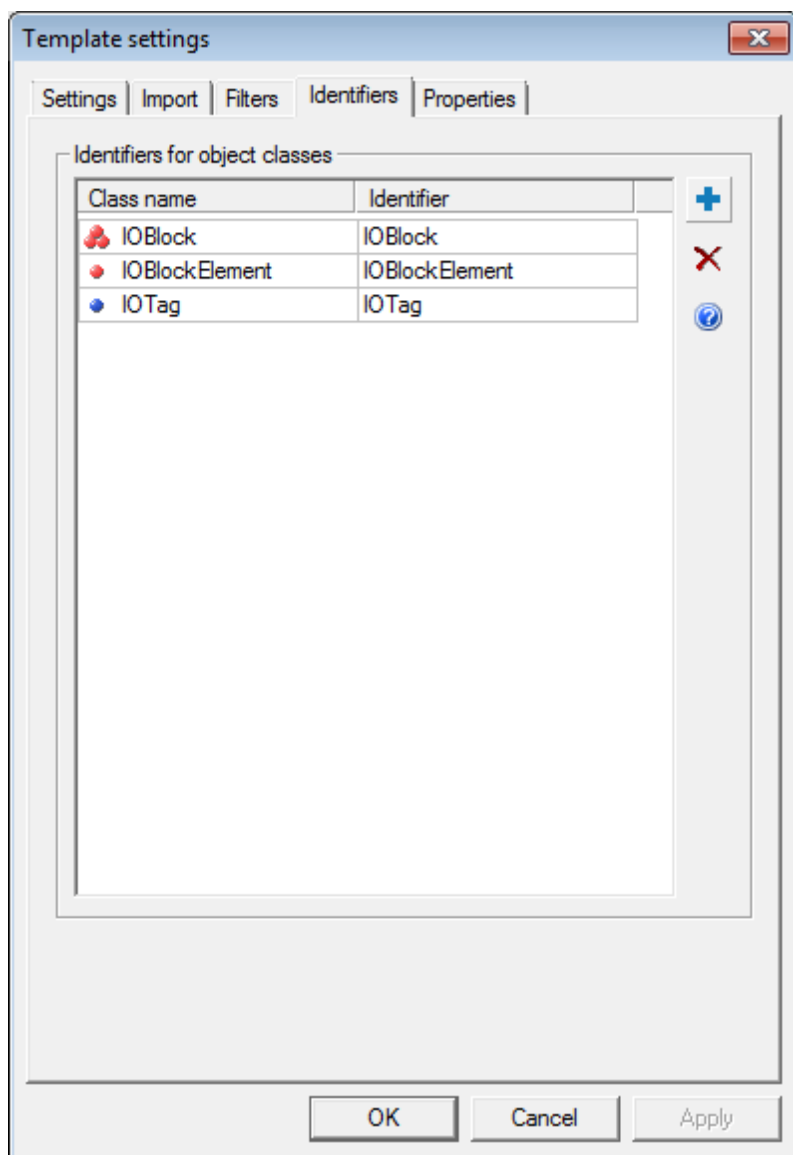
By clicking **Change**, a window opens to select classes, as shown on the next figure.



Object classes

Classes that initially fill in this list are the ones of the root and child objects, if a new template is being created. Users can also add other classes, by clicking , or remove a class by clicking .

- **Identifiers:** On this tab, users can define identifiers for the selected object classes. The initial status of this list is empty






Identifiers tab

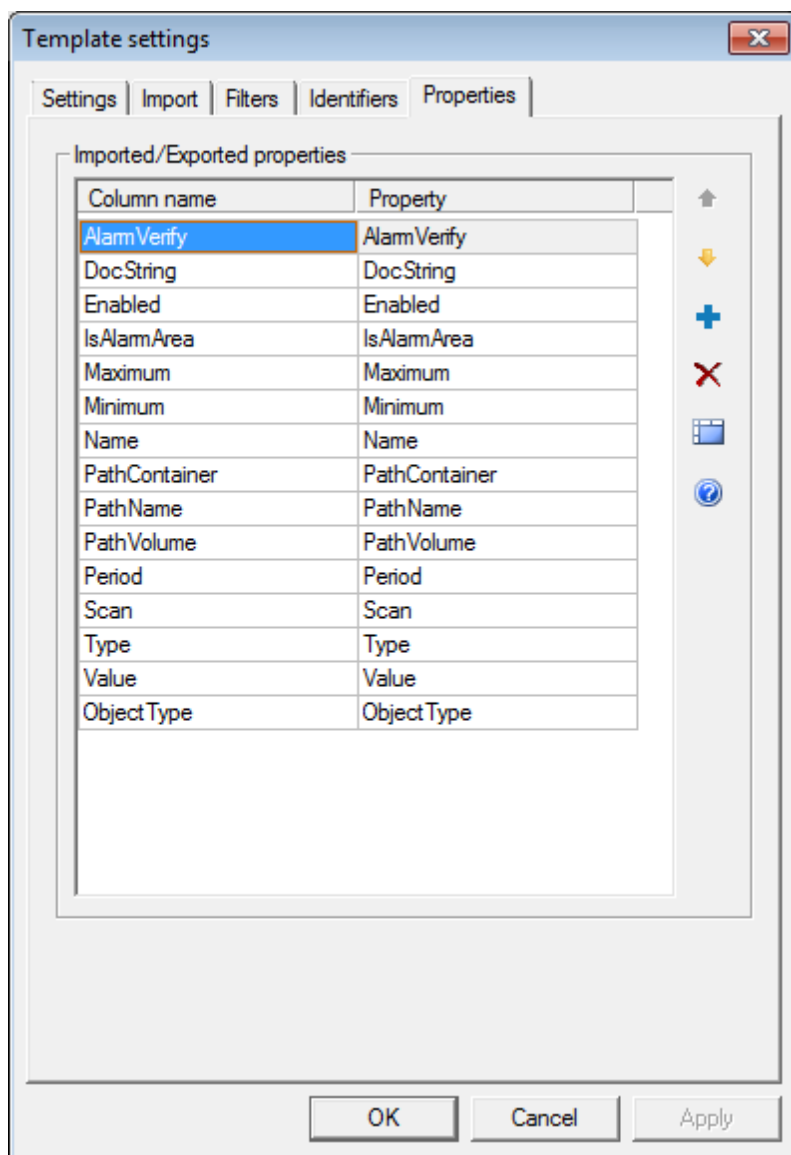
The available options on this tab are described on the next table.

Available options for Identifiers tab

OPTION	DESCRIPTION
Class name	Indicates the name of the selected class in this option.

OPTION	DESCRIPTION
Identifier	Allows users to change the value to use on the ObjectType column of the CSV file. This column's initial value is always the object's class name. For each changed value here, an entry is generated on the INI file in Types section. These values are not case-sensitive (that is, "AAA", "aaa", and "aAa" are the same value). If users define the same value for more than one type, only the first type is considered during the import process, and an object may be created with a wrong type.
	Adds object classes.
	Removes the selected object class.
	Displays a window with a help text.



- **Properties:** On this tab, users can select which object properties they want to use on the import or export process. This list's initial value is **ObjectType** and all other properties must be manually added




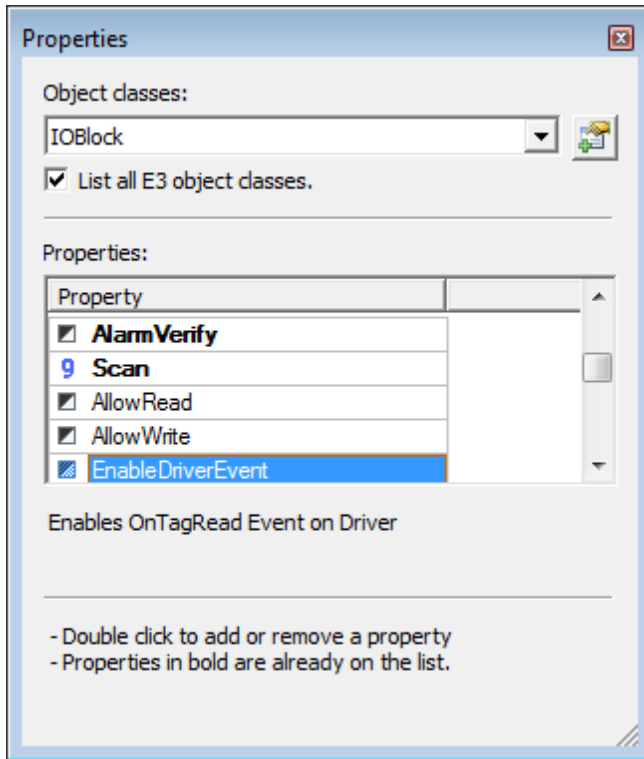
Properties tab

The available options on this tab are described on the next table.

Available options for Properties tab

OPTION	DESCRIPTION
Column name	Allows users to change the value to use as a column's name on CSV file's header. This column's initial value is always the name of the property itself. For each changed value on this column, an entry is generated on the INI file in Columns section. Column names are not case-sensitive (that is, "AAA", "aaa", and "aAa" are the same value). If users define the same column's name for more than one property, only one of them is properly identified, and all columns with the same name point to the same property. In this case, some values may be overwritten.
Property	Indicates the property being imported or exported.
⬆ and ⬇	Redefines column's sort order when changing property's sort order on the list.
+	Adds properties to this list.
×	Removes properties from this list, except for ObjectType . Alternatively, users can use the DELETE key to remove a property.
	Creates a column's name linked to more than one property. Select the properties to group and then click this option. Column names are grouped on the same row, using the column's name defined for the property at the top of this list.
	Displays a window with a help text.


By clicking , a window opens to select properties, as shown on the next figure.



Properties window

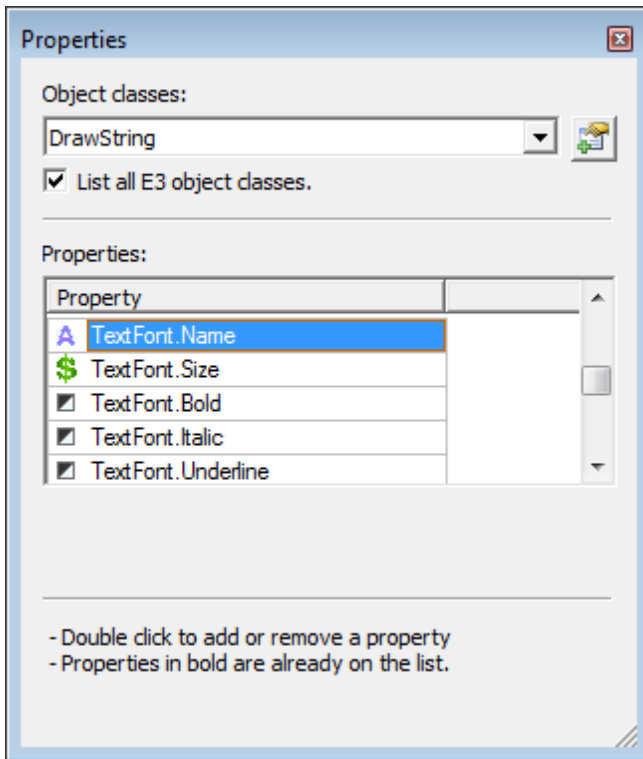
The available options on this window are described on the next table.

Available options for Properties window

OPTION	DESCRIPTION
Object classes	Displays object classes that match the selected filter starting at the root object.
	Adds all properties from the selected object type in the previous option.
List all E3 object classes	If selected, the object's combo box shows all existing classes in E3, regardless of a filter or root object.
Properties	Displays properties of the selected object.

Properties displayed in bold on this list were already added to the list that defines columns on the CSV file. By double-clicking a property, users either add it or remove it from the list, depending on whether it was on the list or not. If a property was grouped with others, a double-click only removes this property from the group, keeping the other properties correctly grouped.

TextFont-type properties contain internal properties that configure certain font features, such as type and size. They are exported with the main property's name (according to the object), followed by the name of the internal property, separated by a period (as in **TextFont.Bold**, for example). In the template settings, internal properties are displayed separately, so that users can select them one by one.



TextFont-type properties

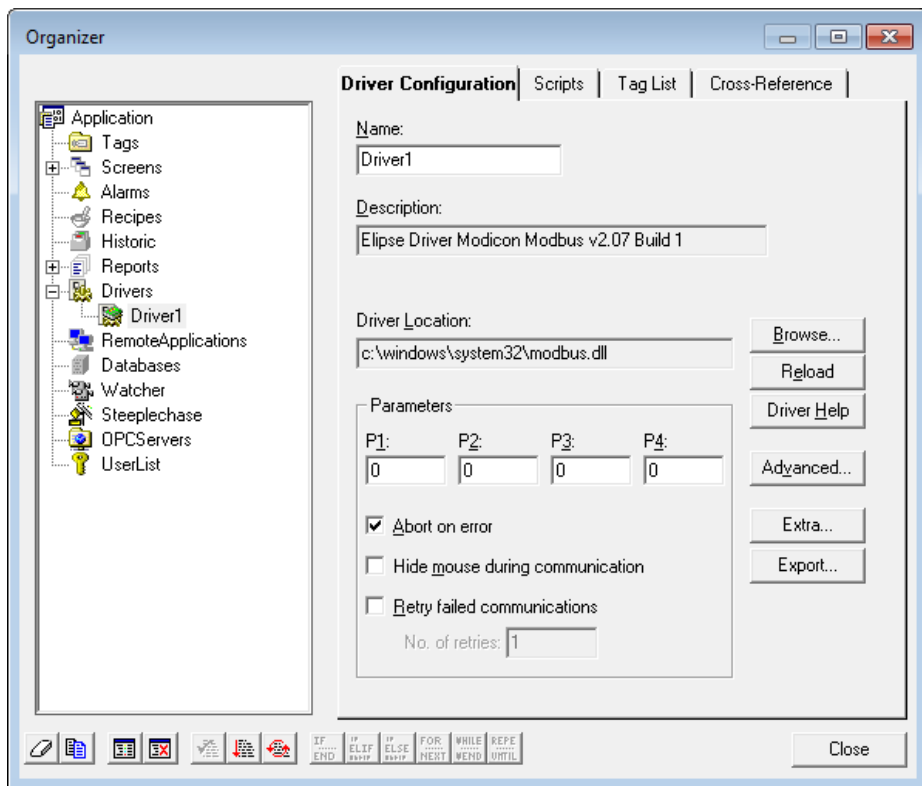
2.6.5 Importing SCADA Objects to E3

Starting with Elipse SCADA version 2.29, a new functionality was incorporated, allowing users to import Tags, alarms, and certain Elipse SCADA's Screen objects into E3.

2.6.5.1 I/O Tags (PLC and Block)

Elipse SCADA's I/O Tags are imported individually for each I/O Driver. To do so, open an application in Elipse SCADA and follow these procedures:

1. In Elipse SCADA's Organizer, open the Drivers folder and select a Driver.
2. Click **Export**.

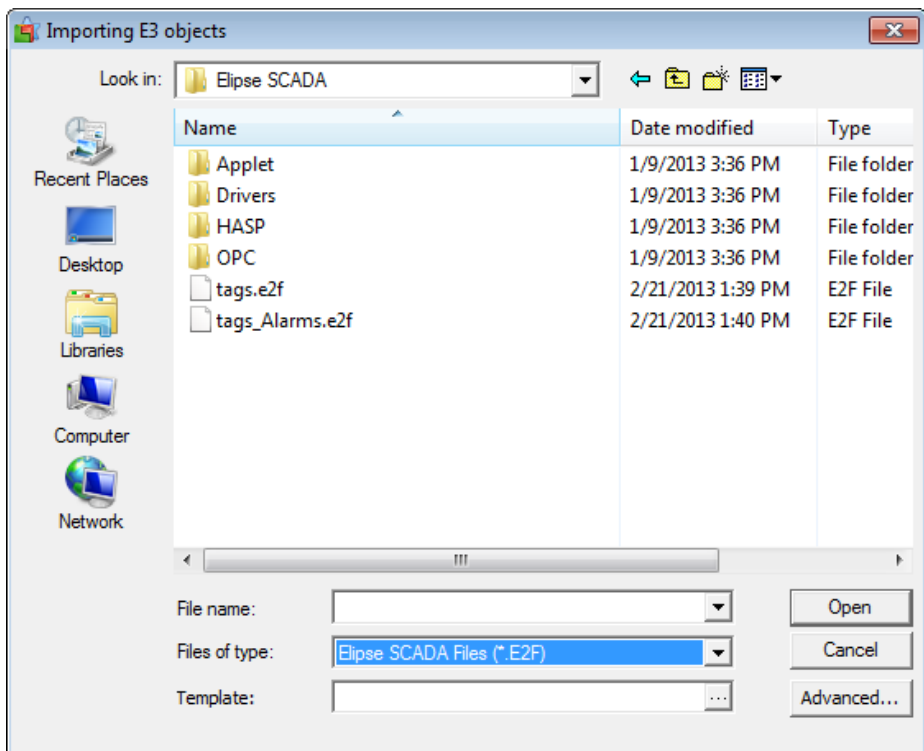


Exporting Drivers

3. Select a file's location and name to generate. In addition to a file with Tag settings, a new file is generated with the same name followed by an _Alarms suffix. This file is used later when importing alarm configurations to E3.

To import these Tags to E3, follow these procedures:

1. Insert an I/O Driver in Organizer.
2. Rename this Driver to the same Driver's name used in Elipse SCADA application, so that all Driver's Tag references are correctly imported later.
3. Right-click the I/O Driver and select the **Import** item.
4. On the list of file types, select the **Elipse SCADA files (*.e2f)** option, and then select the file previously exported, without the _Alarms suffix. There is no need to select a template.

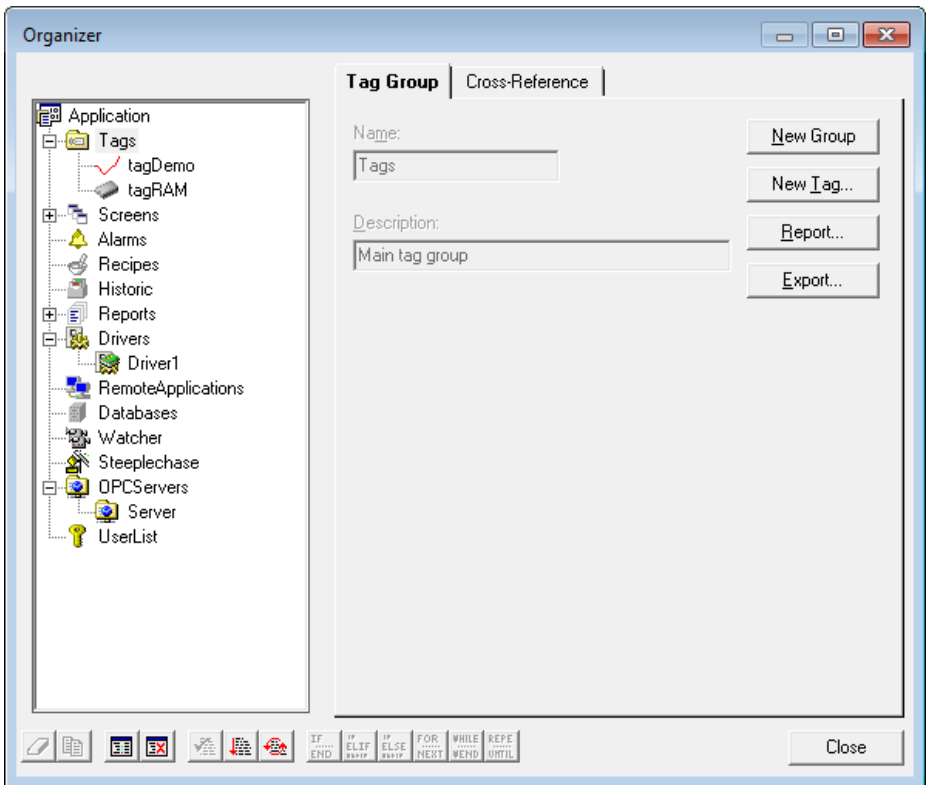


Importing I/O Tags

2.6.5.2 RAM and Demo Tags

To export **RAM** and **Demo** Tags, follow these procedures:

1. In Eclipse SCADA's Organizer, click the **Tags** item.
2. Click **Export**.



Exporting RAM and Demo Tags

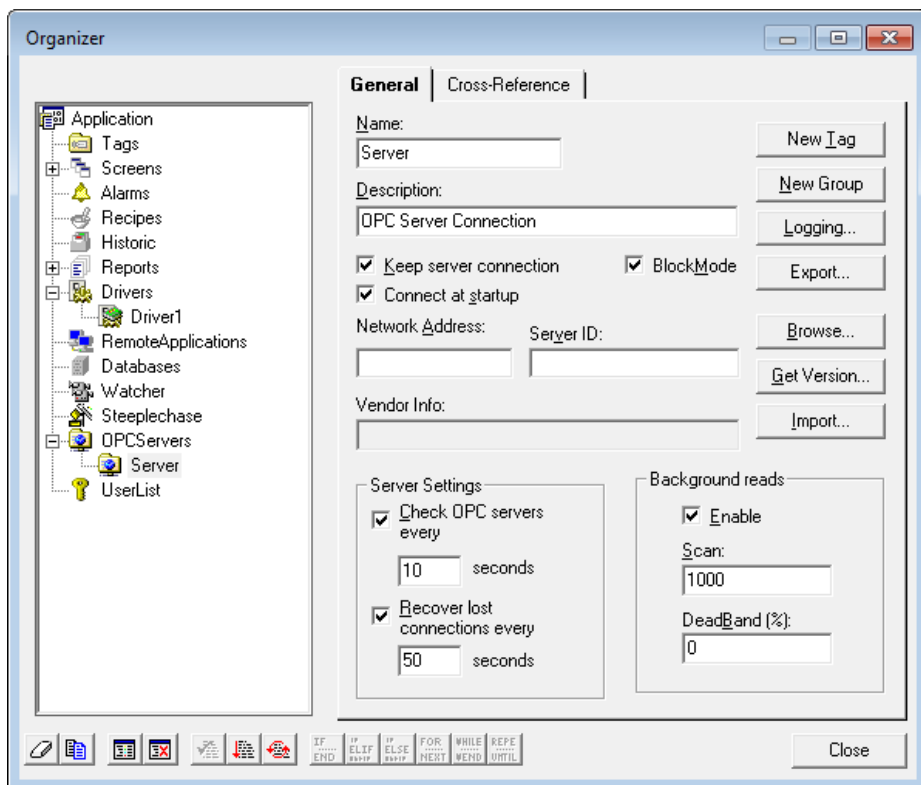
3. Select a file's location and name to generate. In addition to a file with Tag settings, a new file is generated with the same name followed by an _Alarms suffix. This file is used later when importing alarm configurations to E3.

To import these Tags to E3, follow these procedures:

1. Insert a Data Server in Organizer.
2. Rename this Data Server to Data, so that all Screen object Links are correctly imported later.
3. Right-click this Data Server and select the **Import** option.
4. On the list of file types, select the **Elipse SCADA files (*.e2f)** option, and then select the file previously exported, without the _Alarms suffix. There is no need to select a template.

2.6.5.3 OPC Server's Tags and Settings

1. In Eclipse SCADA's Organizer, select the **OPCServers** item and click the desired OPC Driver.
2. Click **Export**.



Exporting OPC Server's settings and Tags

3. Select a file's location and name to generate. In addition to this file with OPC Tag settings, a new file is generated with the same name, followed by an _Alarms suffix. This file is used later when importing alarm configurations to E3.

To import these OPC Tags to E3, follow these procedures:

1. In Organizer, insert a new OPC Driver.
2. Rename this OPC Driver to the same OPC Driver's name used in Elipse SCADA application, so that all OPC Driver's Tag references are correctly imported later.
3. Right-click this OPC Driver and select the **Import** option.

4. On the list of file types, select the **Elipse SCADA files (*.e2f)** option, and then select the file previously exported, without the `_Alarms` suffix. There is no need to select a template.

2.6.5.4 Alarm Configuration

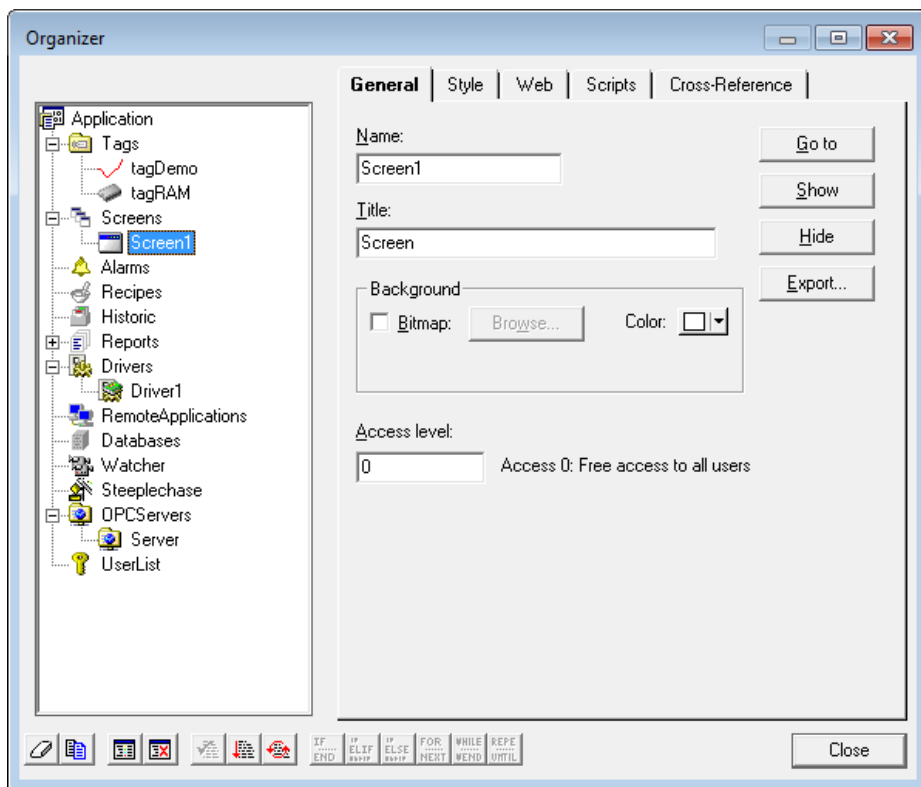
An Alarm Configuration is exported automatically when exporting Tags, by following the previously described steps. In addition to the file with Tags, a file is generated with the same name followed by an `_Alarms` suffix. For example, if the selected name is "InternalTags", then the generated files are InternalTags.e2f and InternalTags_Alarms.e2f. This second file with the `_Alarms` suffix contains the alarm Configuration of all exported Tags. To import these alarms to E3, follow these procedures:

1. In Organizer, insert a new Alarm Configuration, and insert an Area.
2. Right-click this Area and select the **Import** option.
3. If this import process was successful, alarms must appear without any warnings. If the corresponding Tags were already imported, all references must appear in blue.

2.6.5.5 Screens

Exporting Elipse SCADA's Screens is partial and only supports a subset of Screen objects. To export a Screen, follow these procedures:

1. In Elipse SCADA's Organizer, select the **Screens** item and click the desired Screen.
2. Click **Export**.



Exporting Screens

3. Select a file's location and name to generate.
4. In Organizer, insert a new Screen.
5. Right-click this Screen and select the **Import** option.
6. On the list of file types, select the **Elipse SCADA files (*.e2f)** option, and then select the previously exported file. There is no need to select a template.

If this import process was successful, that Screen is filled with the objects, and no error message is displayed. Image files used by this Screen must be handled as follows:

- **Image files with relative paths in Elipse SCADA's application:** These files must be inserted manually as Resources in E3 projects. Users can insert several resources at once, by right-clicking the **Resources** item in Organizer and selecting the **Insert resource in** option
- **Image files with absolute paths:** these files must remain on their original directories. E3 searches for them on the same directory where they can be found by an Elipse SCADA's application

NOTE: It is advisable to insert all files in a project as Resources, so that E3 Viewer can download them automatically via network. This avoids the need to install all files manually on client machines.

2.6.6 Links

To import or export Links in E3, users must select the corresponding option in a template. There is no way to exclude a specific Link type, either all of them are imported or exported, or none at all.

Each Link takes one row in a CSV file. Link identification is performed using the following keywords:

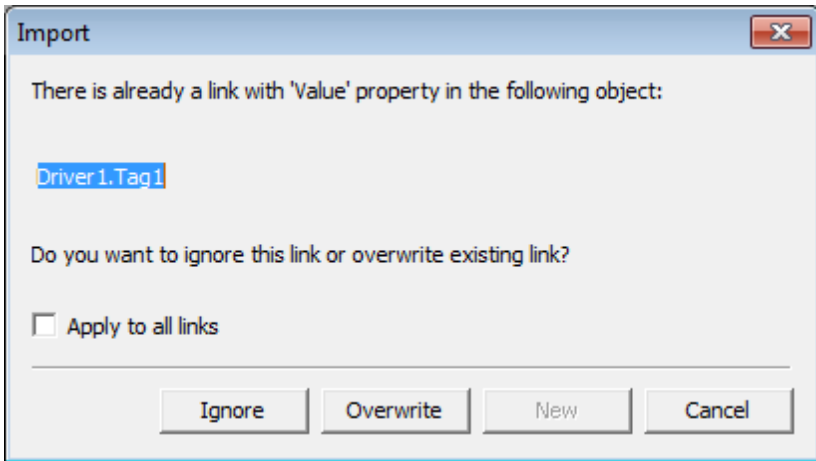
- **AgSimple:** Simple, Bidirectional, or Reverse Links (they must be distinguished by their **Reverse** and **Bidirectional** properties)
- **AnalogBind:** Analog Links
- **AnimationBind:** Digital Links
- **TableBind:** Table Links

Link properties or fields are imported or exported in the same way as object properties, each one with a column in a CSV file. All Links have the **Source** and **Property** properties; in addition to these ones, the properties for each Link are:

- **AgSimple:** **Reverse**, **Bidirectional**
- **AnalogBind:** **SrcHiValue**, **SrcLoValue**, **DstHiValue**, **DstLoValue**
- **AnimationBind:** **BlinkOn**, **BlinkOff**, **OnValue**, **OffValue**, **BlinkOnValue**, **BlinkOffValue**

Table rows are created according to a user-defined index. If this index is not a number, an error message is then displayed (invalid name). If this index does not exist (for example, there are only two rows in a table, and users want to insert a row numbered as five), the remaining rows are created with default values.

All Links are imported or exported, regardless of user-selected properties. If a Link to a given property already exists, users are prompted about what to do. Otherwise, they are created.



Importing a pre-existing Link

In an object's name, users must inform its complete path, in the format **Object.Links.Name**. For example:

```
'Links indicates it is a Link
'Value is the property with that Link
Text1.Links.Value
```

2.6.7 Collections and their Items

To import or export collections in E3, users must select the corresponding option in a template. There is no way to exclude only some collections, either all of them are imported or exported, or none at all.

Columns in each collection depend on the properties of that collection. This is handled the same way as object's property columns.

In case of collections and collection items, properties must be included in an INI file manually. It is not possible to select these properties via template settings.

Collections can be imported, and their properties can be updated. Since collections always exist, and there is no way to create another collection of the same type, users are asked whether they want to ignore or overwrite the existing collection.

If the collection item being imported already exists, users are asked whether they want to ignore it, overwrite it, or create a new one. In case users select the later option:

- In case of Pens and Axes, their names are properly auto-incremented
- In case of Table Link rows, they are created at the end of a table
- In case of Legend columns, an error message is displayed informing that either their names are not valid, or that column already exists and its name cannot be auto-incremented (Legend columns have pre-defined names, and it

is not possible to create columns with different names)

In an object's name, users must inform its complete path, in the format **Object.Collection.Name**. Example:

```
E3Chart1.Pens.Pen1
```

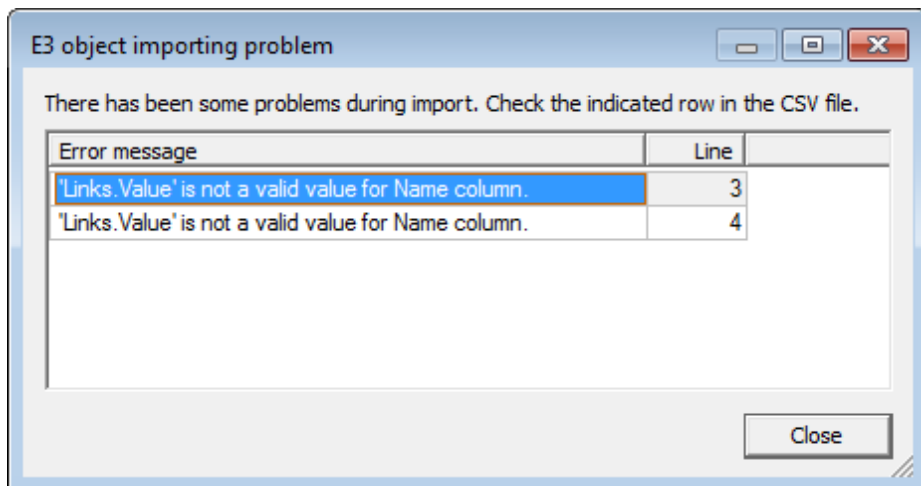
On **Type** column, one of the following keywords must appear:

- **IDispChartPen**: E3Chart Pens
- **ILegendColumn**: E3Chart Legends
- **IAxis**: E3Chart Axes
- **ITableBindRow**: Table Link rows

2.6.8 Logs and Failure Report

During the import or export process, a log file with errors and other relevant events that occurred during the process is generated, in case the **ImportExport** log section is enabled. To enable this section, see chapter **Advanced Settings**.

By the end of the operation, there is an option to view an import failure report. In this report, there is a list of failures which are probably CSV file errors, such as an object not found, among others.

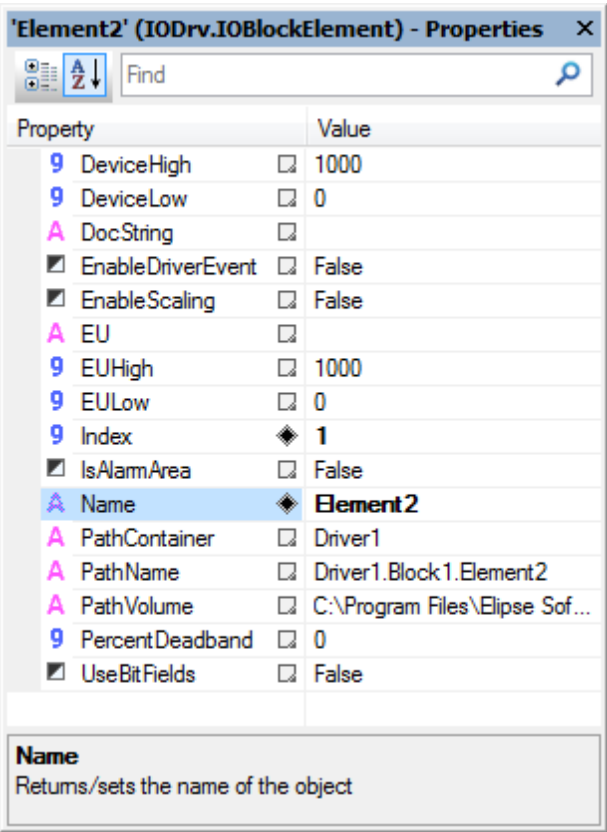


Import failure report

2.7 Properties List

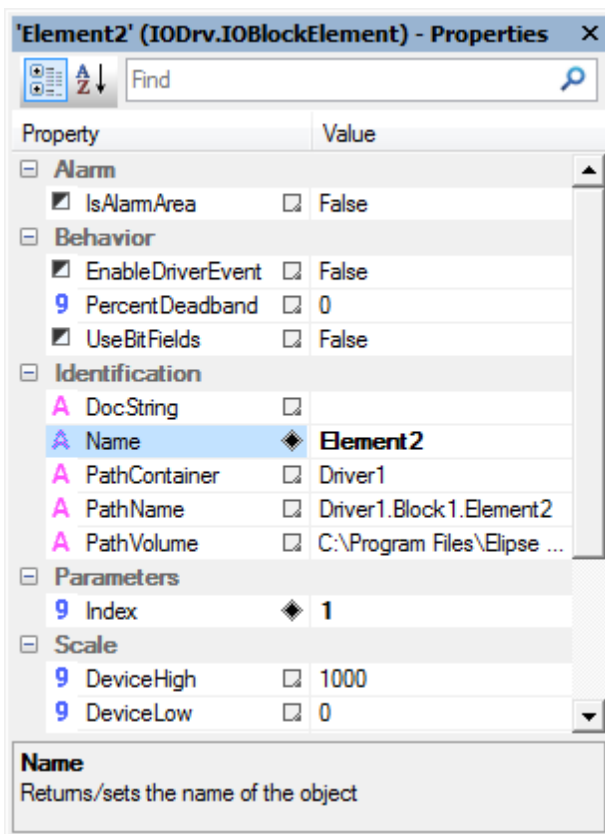
Properties List is a window for configuring properties of the selected object.

Properties List's title always displays the name of the currently selected object. For this window to be visible in the project, users must select the **Properties List** option on **View** menu. The next figure shows a Properties List of an I/O Block Element object with its properties sorted alphabetically.



Properties List sorted alphabetically

The Properties List of the next figure displays the previous object with its properties sorted by category.




Properties List sorted by category



NOTE: When selecting multiple objects, the Properties List displays only properties common to the selected objects, with their values corresponding to the last selected object. The same criteria is used if the Properties List is sorted by category, that is, the displayed categories correspond to the last selected object.

Properties List's footer displays a quick description of the selected property. The available options on this window are described on the next table.

Available options on Properties List

ICON	OPTION	DESCRIPTION
	Sort by category	Displays all properties of the selected object organized by category.
	Sort alphabetically	Displays all properties of the selected object organized alphabetically.

ICON	OPTION	DESCRIPTION
	Find	Allows filtering the list by the property's name or partial name.

Users can configure a value to a property by typing it directly in its respective **Value** column. On the right side of a property's name there is an icon that indicates its current status: The icon  indicates that property's value is the default, that is, its value was not modified by the user, and the icon  indicates that property's value was modified by the user (a modified value appears in bold). In addition, clicking this icon opens a contextual menu with the options described on the next table.

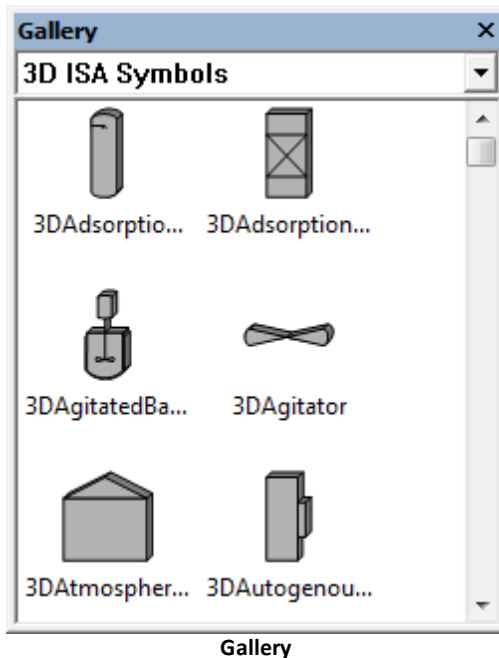
Available options on property's contextual menu

OPTION	DESCRIPTION
Reset	Returns the value of the selected property to its default value, if it was modified by the user.
Copy	Copies the value of the selected property to the Clipboard.
Paste	Pastes the Clipboard value to the value of the selected property.
Edit	Allows editing the value of the selected property.

NOTE: The options on a property's contextual menu may be enabled or disabled, depending on property's data type.

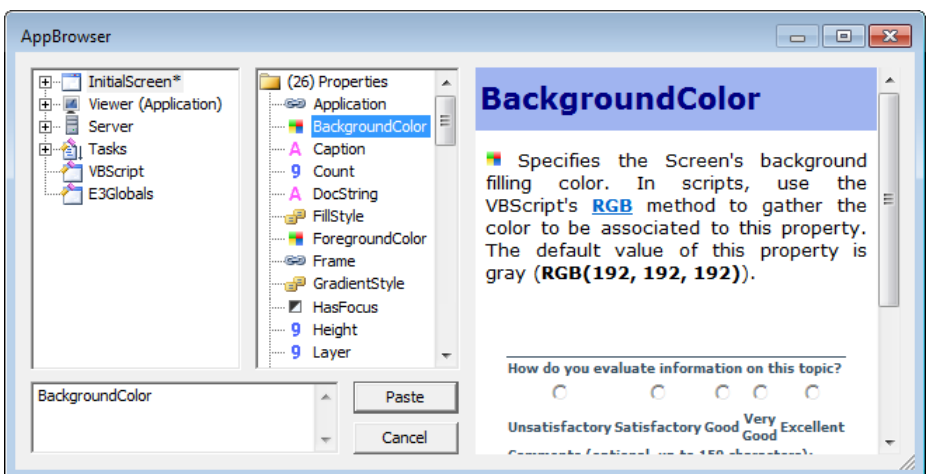
2.8 Gallery

Collection of graphical objects, which can be dragged and dropped into application Screens. These objects are Metafiles (WMF, or Windows MetaFile) objects.



2.9 AppBrowser

The **AppBrowser** is a tool that helps users to develop their applications by informing a logical expression, a Link, or a value for the property currently manipulated, according to the selected object. Thus, it is possible to minimize errors during the development of an application.



The left panel displays E3 objects that can be used to compose the text that is the result of using AppBrowser. According to its usage context, some objects cannot be used and are not even displayed here.

The center panel shows selected object's methods and properties, and on the right panel there is a help text for the selected property or method.

The panel at the bottom displays the resulting text from AppBrowser, next to the **Paste** and **Cancel** options. Click **Paste** to accept the result and copy this value to the desired area. Click **Cancel** to ignore it.

NOTES:


- When selecting Tags, AppBrowser is always opened on the last position, not on the position pointed by the current link.
- AppBrowser has an **Auto Complete** function: type the name of an object to select it automatically.

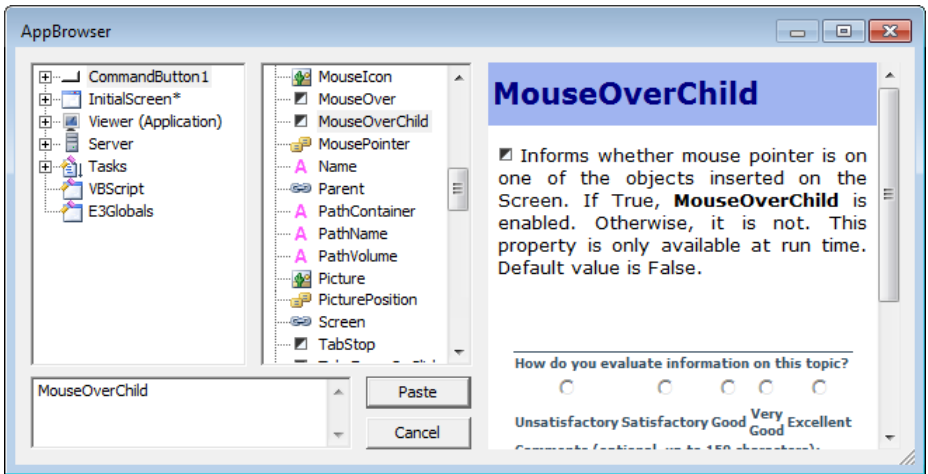
There are three different ways to use AppBrowser:

- Via **scripts**
- Via **Links**
- Via some object's **properties** with the name of another object as their value

Each one of these ways is discussed on the next topics.

2.9.1 Access via Script

To use AppBrowser from a script, open a script view and click  on the **Scripts** toolbar. In this mode, objects are separated as shown on the next figure.




AppBrowser via scripts

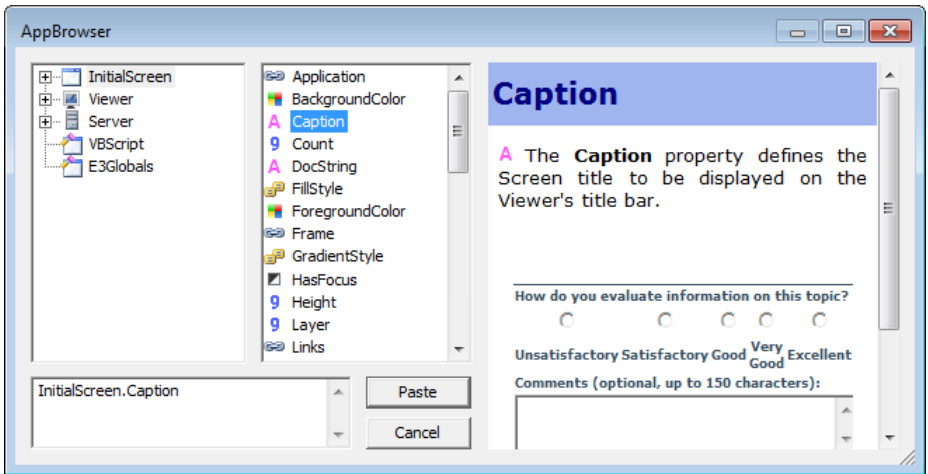
On the left panel:

- The first item, displayed isolated, is the **Context**. A context object is the one originating the call to AppBrowser, that is, the script's owner
- The second item is the full **Hierarchy** to reach a context object, if this context is not in project's root. This object can be expanded and the context object itself can be seen in this hierarchy
- If the context is not a server object, the third item displayed is the **Viewer** (Application object)
- The fourth item is the **Server**. It lists all server objects belonging to an application. If this item is the current context, it contains an Application indication
- The fifth item is called **Tasks**. This is where the most common tasks to execute via scripts appear. There are two: **Load report** (which AppBrowser's result is an expression to load a Report) and **Open screen** (whose result is an expression to open the selected Screen, equivalent to the **Open Screen** Pick)
- Finally, the sixth item shows all **VBScript** functions available for scripts

According to the selected object, the center panel shows its properties and methods.

2.9.2 Access via Link


To access AppBrowser from a Link, open the Properties Window, select the **Links** tab, the desired property, and then click  on the right. AppBrowser is then opened and objects are displayed according to the next figure.

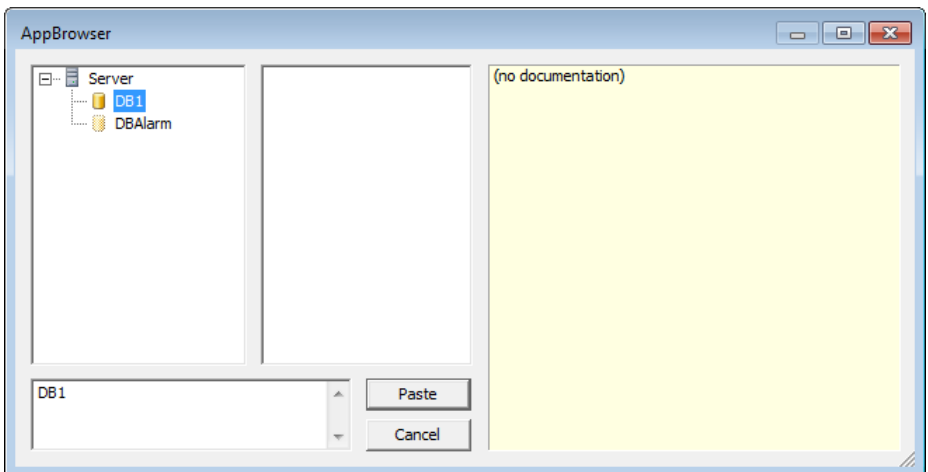


AppBrowser via Links

In this case, only object properties are displayed on window's center panel. Their methods are not displayed, because they are not allowed in Links.

2.9.3 Access via Property

Some properties allow using AppBrowser to help properly fill in the expected value. These properties, when selected, show a  button to the right of the **Value** field on the Properties List. By clicking it, AppBrowser is opened and displays only objects that can be used as values for the selected property. Properties and methods of these objects are omitted. This is the case, for example, of Formula's **DBServer** property. AppBrowser only shows the existing **Database**-type objects in an application.



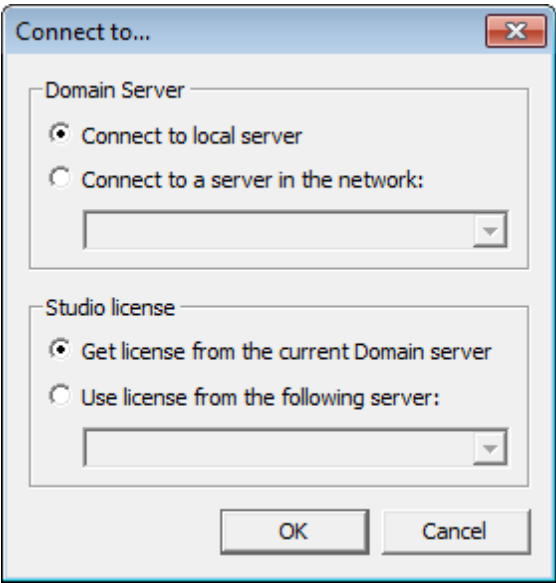
AppBrowser via property

Properties that allow using AppBrowser are:

- **Formula's, Historic's, and Storage's DBServer**
- Alarm Server's **DataSource**
- Viewer's **InitialScreen**
- FrameSet's **SplitLink**

2.10 Connect To

The **Connect To** option is used to determine an E3 Studio connection to a server. This option allows configuring in which Domain server an E3 Studio must connect, and also allows specifying whether an E3 Studio must retrieve a license from the server where the Domain executes or if it must retrieve that license from another server. To use this resource, click the **File - Connect to** menu to open the dialog box on the next figure.



Connect to window

Available options for Connect to window

OPTION	DESCRIPTION
Connect to local server	Enables a connection to a local server.
Connect to a server in the network	Enables a connection to a network server. To do so, select it on the combo box.
Get license from the current Domain server	Uses a license from a server running a Domain.
Use license from the following server	Uses a license from another server, not the one running the current Domain.

If a connection to either server (Domain or license) is down, E3 Studio is then disconnected from the other server. Its last configuration is stored on Windows Registry, and the next time E3 Studio opens, it connects to both Domain and license servers used for the last time.

If a license server is not available or there are no licenses left, then E3 Studio works in **Demo** mode. An E3 Studio without a license (**Demo** mode) can only connect to an E3 Server also running in **Demo** mode.

If a license server is other than a Domain server, the name of this license server is displayed in the title of E3 Studio's window: **License on local server** or **License on <Server_Name>**.

If a license server is specified, E3 Server's license window on Domain server identifies the name of a server borrowing a license for E3 Studio: **SERVER1 (License borrowed from SERVER2)**. In this case a license listed on the Domain server is not part of the total amount of E3 Studio licenses in use on that server.

If a Domain server does not have a license, and an E3 Studio connects to this server by using another server license, then this Domain server temporarily switches from **Demo** to **Studio** mode, switching back to **Demo** mode as soon as E3 Studio session closes.

NOTE: When E3 Studio is using a license borrowed from another server, it must remain open while this application is executing. If it is closed while this application is executing, the borrowed E3 Studio license (which allows executing an application for up to six hours) is released, and E3 Server ends application execution immediately (no more than 10 seconds).

TIP: When users connect to a server, it is important that applications be opened using a network path. Instead of using C:\projects\project.dom, use \\server\projects\project.dom. This way, E3 Studio and a remote E3 Server can access these files using the same path.

A **Domain** is a set of objects and configurations that define a supervisory system. They correspond to Elipse SCADA **Applications**.

E3 is a modular environment to develop and execute supervisory systems, composed by modules described on the next sections.

3.1 E3 Server

E3 Server coordinates all E3 modules. It always runs as a service, even in **Demo** mode, be it registered as a service or with the **/regserver** parameter, and it must also always be running. It can also be started up when a local **E3 Studio** is initialized, or via shortcut (for example, **e3admin -start app.dom**) to run a Domain. It is responsible for:

- Checking and managing user licenses from different E3 modules
- Starting, stopping, or monitoring Domain's runtime process (**E3Run**)
- Opening, editing, or manipulating DOM files
- Controlling user access to Domain objects
- Monitoring other Domain servers, and implementing **Hot-Standby**

E3 Server is capable of working with only one Domain file at a time, and this is called the **open Domain**. Domain files can only be manipulated via E3 Server.

3.1.1 Licensing

E3 Server supports two licensing modes: **Active License** and **Demo**. The licensing mode is defined during server's initialization. If there is a valid protection device (a hardkey- or softkey-type), E3 Server enters the **Active License** mode. If no device is detected, it then enters the **Demo** mode.

If there is a device switching, E3 Server compares licenses of this new device with licenses from the previous device, and then performs the following adjustments:

- If new licenses are **exactly the same** in terms of limitations to the previous device, they are applied immediately
- If new licenses are **less limited** than the ones in the previous device, they are also applied immediately
- If new licenses are **more limited** than the ones in the previous device, E3

Server waits for one minute, so that the previous device be reconnected. By the end of this period of time, if these licenses remain restrictive, the server is then restarted, and the new licenses are applied





NOTE: For more information about licensing on E3, please contact Elipse Software's sales department.

3.2 E3Run

E3Run is the process responsible for executing server objects: Tags, Alarms, Databases, Historic objects, etc., that is, all objects except Screens and Viewer.


E3Run execution is represented by an icon on Windows Notification Area, described on the next table.

Available options for icons on Windows Notification Area

OPTION	DESCRIPTION
	Green arrow: Displayed when a Domain is loaded and running.
	Graysquare: A Domain is loaded, but not running.
	Yellow straight line (spinning): Displayed when a Domain is starting or stopping. This situation occurs in cases when a Domain takes too long to start, as a standby indication.
	Yellow bars: Displayed when a Domain is in standby mode.

E3Run always runs as a service, be it registered as a service or with the **/regserver** parameter. This process uses the REC protocol to connect to an **E3 Server**'s database queue.

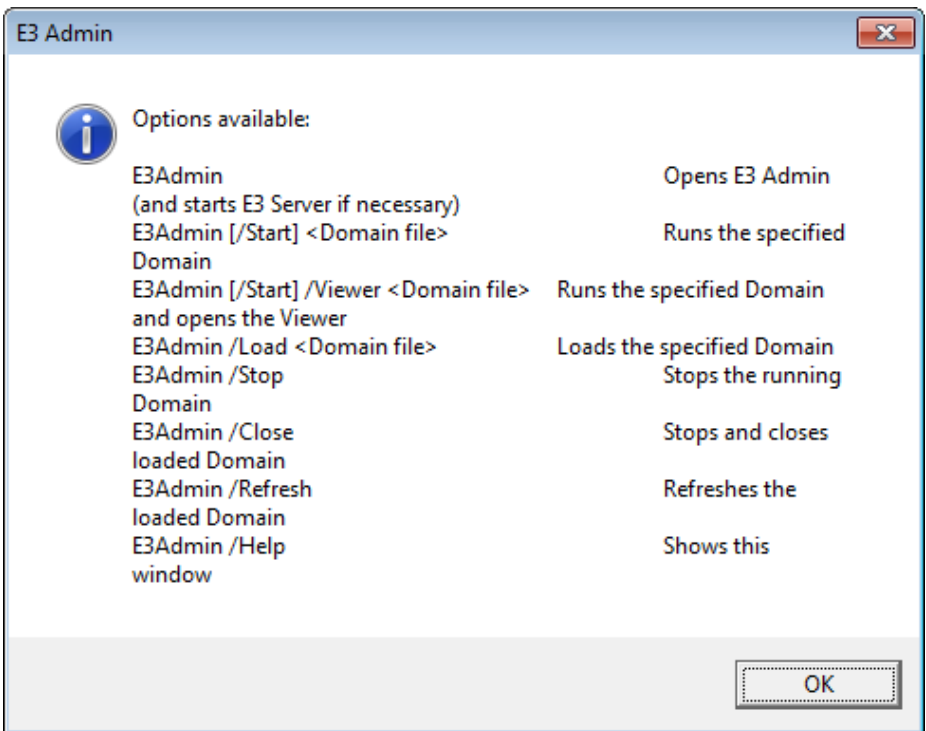
3.3 E3 Admin

E3 Admin is the module responsible for monitoring and controlling an **E3 Server**. It is depicted by the icon  on Windows Notification Area. This module starts whenever a user logs in Windows, or whenever an E3 Server service starts.

E3 Admin is also responsible for handling the following Domain control options via command line: **e3admin <domain_name> [options]** or **e3admin [options] <domain_name>**. Command line options are the following:

- **-start or /start:** Starts a user-informed Domain. This option is not mandatory. Even when it is not informed, this Domain is started
- **-viewer or /viewer:** Runs Viewer for the application

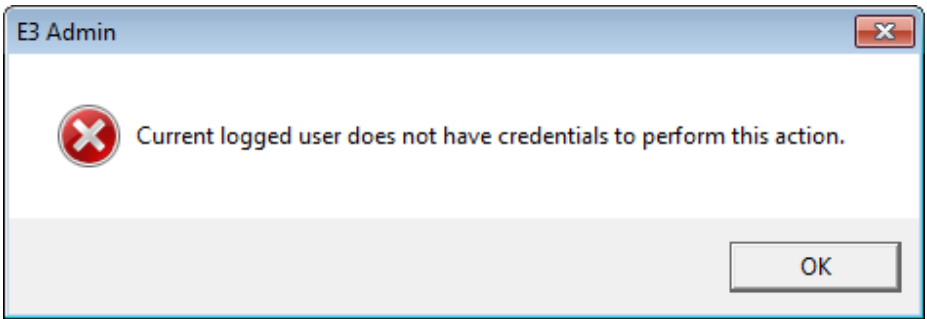
- **-load**: Similar to the **-start** option, but it only loads a Domain, without executing it. It cannot be used with the **-viewer** option
- **-stop**: Stops the running Domain, if there is one. This option must be used alone
- **-close**: Stops and closes the running Domain, if there is one. This option must be used alone
- **-refresh**: Forces a Domain update without using a Viewer
- **-help**: Shows a dialog box with command line options for E3 Admin, as in the next figure



Dialog box with E3 Admin's command line options

If the **-load**, **-start**, or **-viewer** options are used, Windows Vista or later may ask for an Administrator authorization (a process known as *privilege elevation*) whenever E3 Admin has not been started by a user who is a system Administrator (and depending on Windows **User Account Control** configuration).

If the currently user logged in is not an Administrator and Windows **User Account Control** configuration does not allow the authorization window, E3 Admin itself displays an error message, such as the one on the next figure.



E3 Admin error message

NOTE: Windows must be restarted for **User Account Control** configurations to be applied.

In case there are Domain restrictions, the **-load**, **-stop**, **-refresh**, and **-close** options also ask for an E3 user login.

3.4 IOServer

An **IOServer** is a process responsible for executing **I/O Drivers**. IOServers are created, maintained, and monitored by the **E3Run** process.

3.5 E3 Studio

E3 Studio is an application development and configuration environment. It allows opening and editing .prj or .lib files. E3 Studio is a multi-user environment, that is, several E3 Studios can work on the same files at the same time. E3 Studio uses a REC connection to communicate with an **E3 Server**.

3.6 E3 Viewer

E3 Viewer is a runtime user interface. It shows Screens at run time and enables users to operate an application. E3 Viewer can run from anywhere on a network with access to an **E3 Server**, with no need to copy the application to other E3 Viewers, because Screens and bitmaps are loaded on demand at run time.

3.7 Components

A Domain is composed by the files described on next sections.

3.7.1 Configuration File

A .dom file stores four types of information:

- Domain configuration options
- A list with .prj and .lib files containing Tags, Screens, object definitions, etc.
- Server configurations (computers) that executes a Domain
- User configurations and access permissions

3.7.2 Project File

A Domain can have one or more project files. Each .prj file contains object definitions, Tags, Screens, Historics, Alarms, bitmaps, etc. The organization of objects inside a .prj file is free; several folder levels can be created inside a .prj, and each folder can contain any type of object. Users may want to split objects on a supervisory system into two or more .prj files, depending on their needs. At run time, each .prj can be activated, regardless of the other ones, even in different servers.

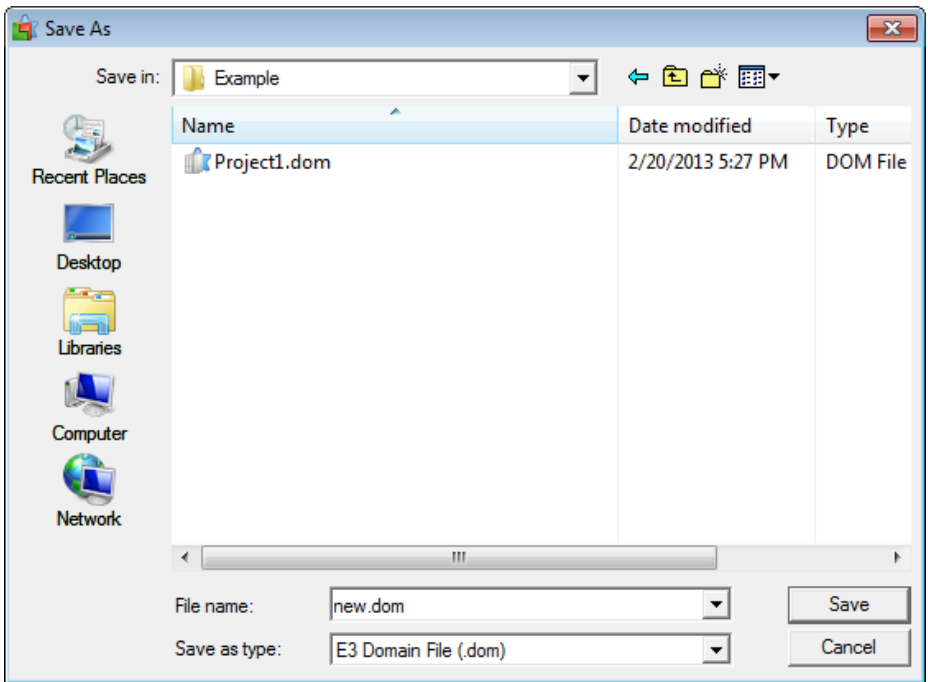
3.7.3 Library File

Library files (.lib) contain user-defined objects (**ElipseX**), which can be used in project files.

3.8 Creating a Domain

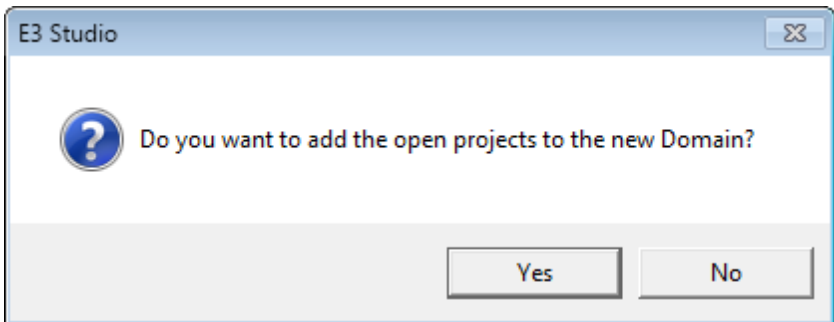
There are two ways to create a Domain in E3:

- Via **File - New Domain** menu. To do so, it is necessary that at least one project or library is opened. When users select this option, E3 then opens a dialog box to choose the new Domain's path and name



Creating a new Domain

Next, users must decide whether they want to include open projects or libraries into this new Domain.




Confirming project or library insertion into a new Domain

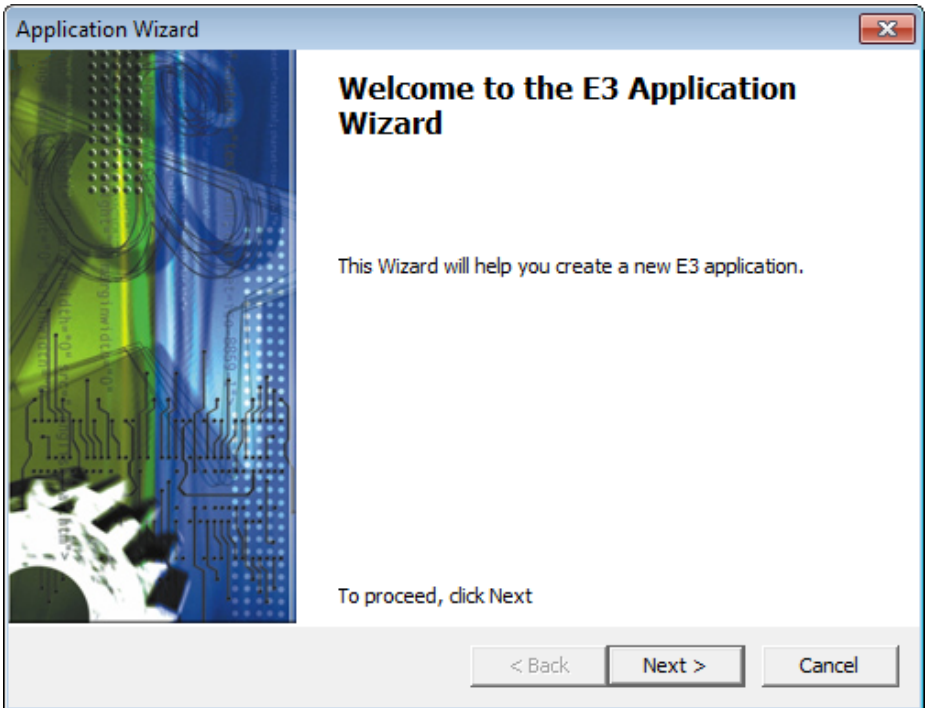
- Via E3 Application Wizard, which allows creating a new Domain with a project (.prj) or library (.lib) file, as seen in the next section

3.8.1 Application Wizard

The E3 Application Wizard is a tool to create a new Domain with a project or a library. This option can be opened using the following ways:

- By clicking **New**  on **Default** toolbar
- By selecting the **File - New Project** menu

Once the Wizard starts, its initial screen is then opened. To proceed, click **Next**.



Initial screen of the Application Wizard

3.8.1.1 Application Type

On this screen, users can select between creating a **Standard application**, an **E3 object library**, or a **Blank application**.

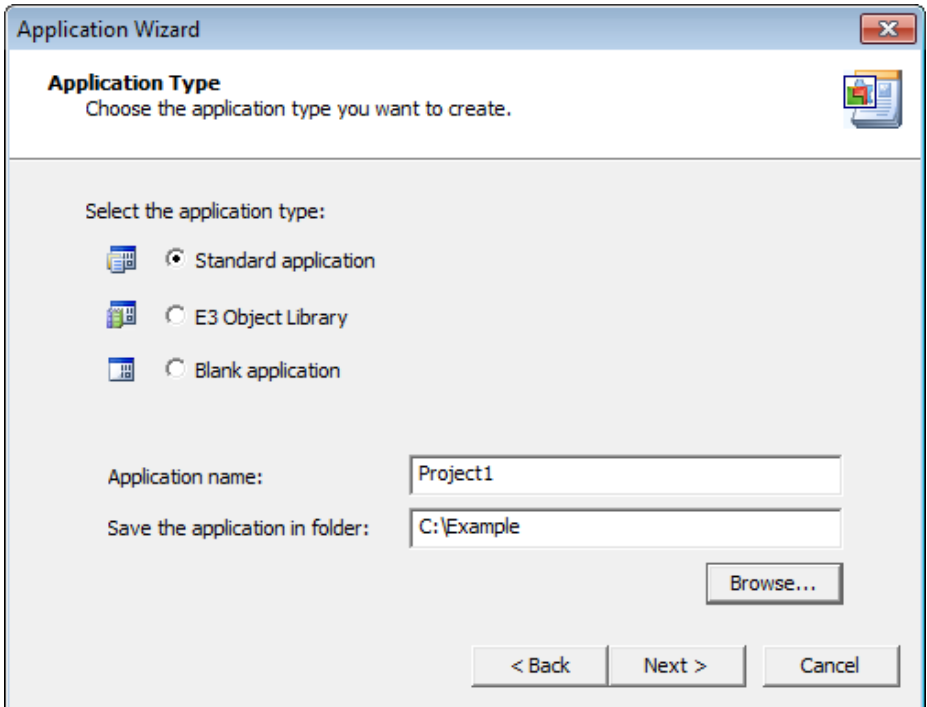
A **Standard application** is the one whose project contains at least one Viewer, one Screen, and one Data Server, also with an option to insert an I/O Driver, a Database, an Alarm Server, and an Alarm Configuration, all these via Wizard.

NOTE: I/O Drivers, Databases, and Alarm screens are only displayed when creating a Standard application.

An **E3 Object Library** is a file used to keep several components, which can be used in applications.

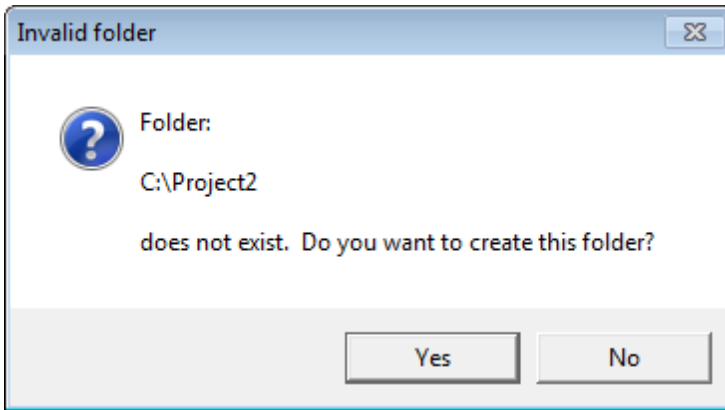
A **Blank application** is a project created with no objects.

On **Application name** item, specify a name for the .prj or .lib file being created (according to what was selected in the previous option). The location to save this application is specified on the **Save the application in folder** item. If necessary, click **Browse**.

The screenshot shows a Windows-style dialog box titled "Application Wizard". The main heading is "Application Type" with a subtitle "Choose the application type you want to create." Below this, it says "Select the application type:" followed by three radio button options, each with a small icon to its left: "Standard application" (selected), "E3 Object Library", and "Blank application". At the bottom, there are two text input fields: "Application name:" containing "Project1" and "Save the application in folder:" containing "C:\Example". To the right of the second field is a "Browse..." button. At the very bottom are three buttons: "< Back", "Next >", and "Cancel".

Application Type screen

If this folder does not exist, users are warned, and they should decide whether they want to create it or not.



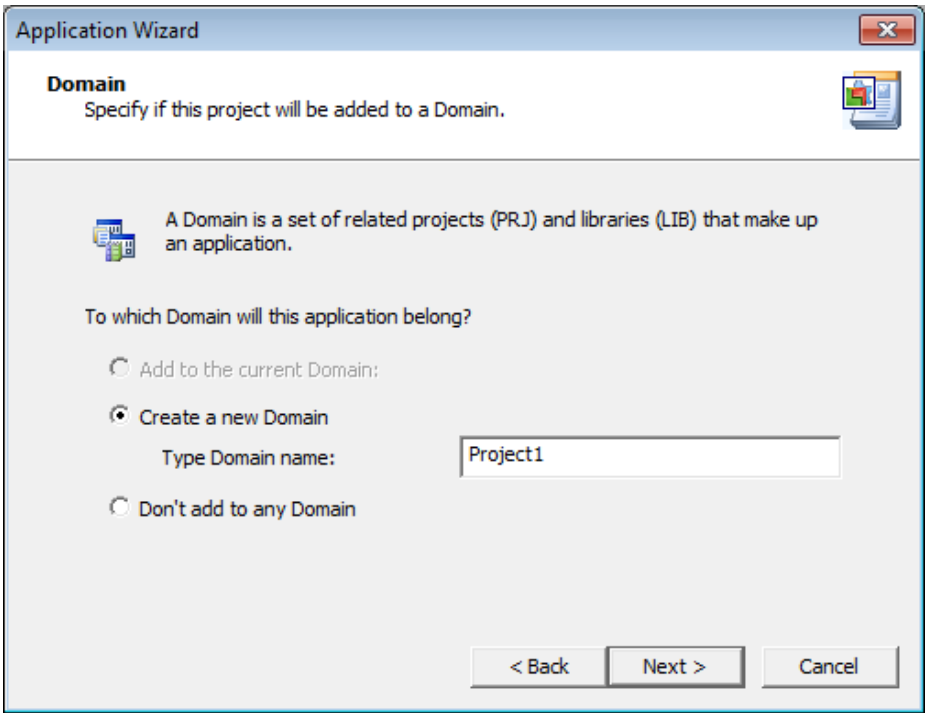
Invalid folder warning

Click **Next** to proceed.

NOTE: The **E3 Object Library** option is discussed later, in chapter **Libraries**.

3.8.1.2 Domain

On this screen, users can decide to which Domain the project or library being created belongs. The **Add to the current Domain** option is only enabled if there are active Domains in this application. By clicking this option, this new project belongs to the current Domain. The **Create a new Domain** option generates a Domain to which the project or library belongs. The name of this new Domain is indicated by the **Type Domain name** option. Finally, with the **Don't add to any Domain** option, this project or library does not belong to any Domain.

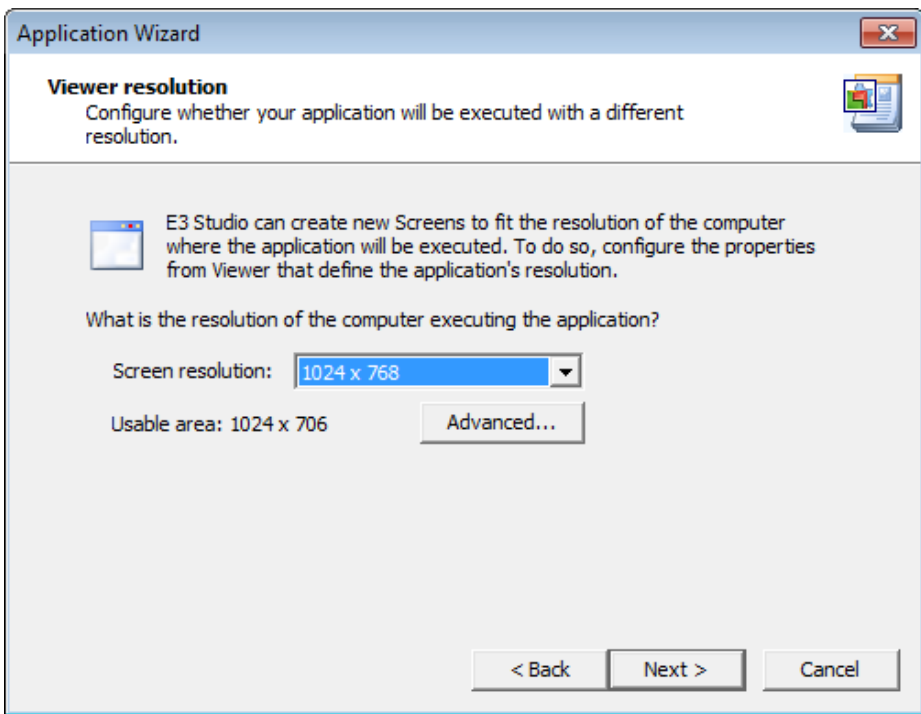


Domain screen

Click **Next** to proceed.

3.8.1.3 Viewer Resolution


On this screen, users can configure Viewer properties by defining a working resolution for this application, that is, the resolution of the computer that executes this application. Thus, Screens can have their sizes defined to fit Viewer's window with no scroll bars. The **Screen resolution** option allows users to select from a series of pre-defined resolutions, whereas the **Advanced** option allows users to customize this value.

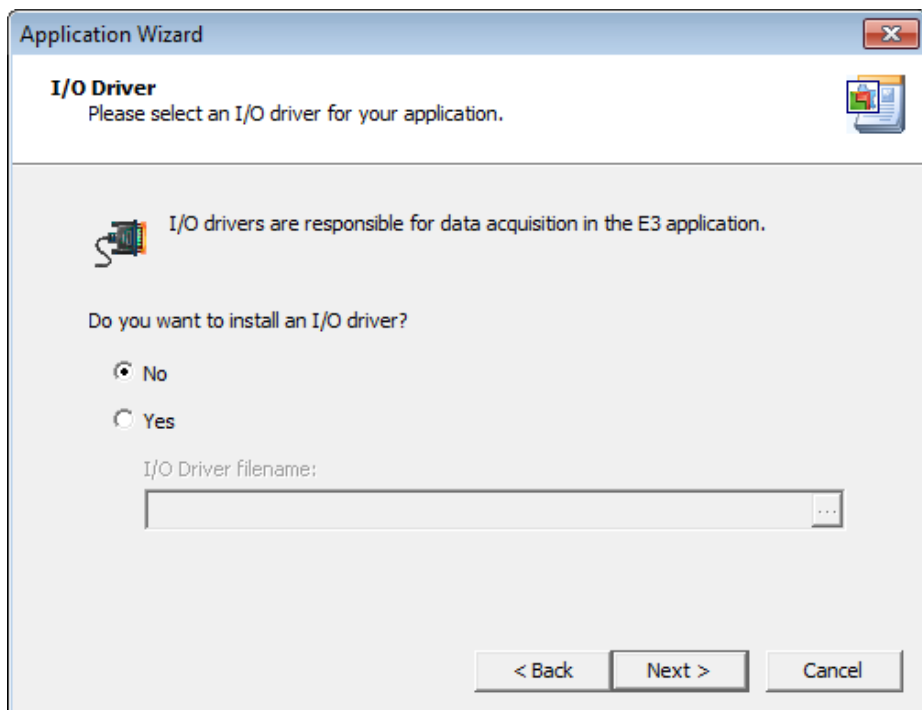


Viewer Resolution screen

Click **Next** to proceed.

3.8.1.4 I/O Driver


On this screen, users can add an I/O Driver object to this project. If they add it, it is possible to configure a .dll file used by this Driver, in the **I/O Driver filename** option. To search for a file, click .

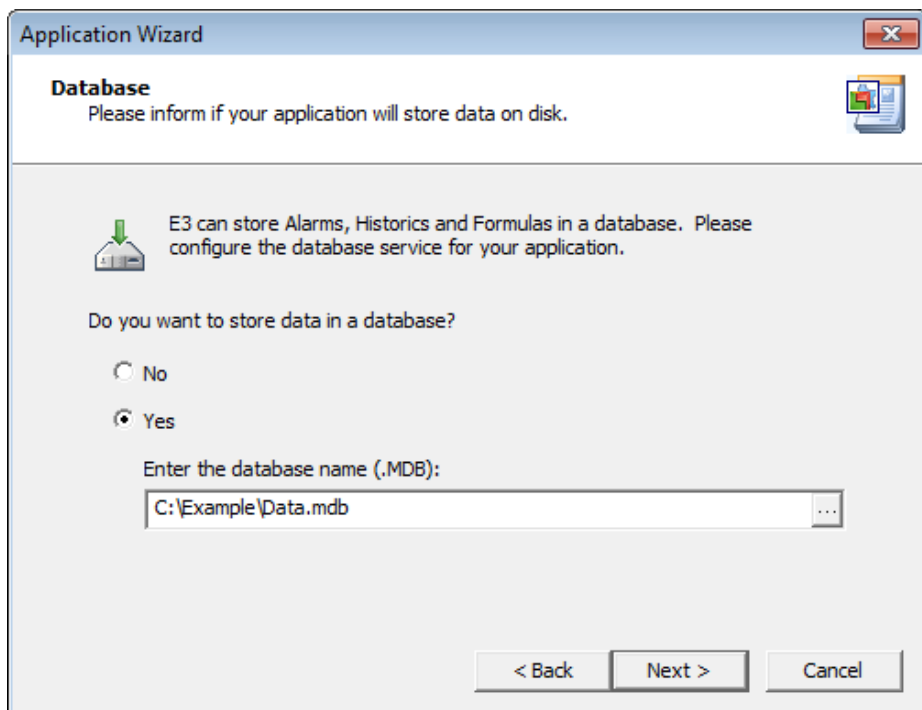


I/O Driver screen

Click **Next** to proceed.

3.8.1.5 Database

On this screen, users can add a Database object to this project. If they add it, it is possible to configure an .mdb file used by this Database, in the **Enter the database name (.MDB)** option. To search for a file, click .

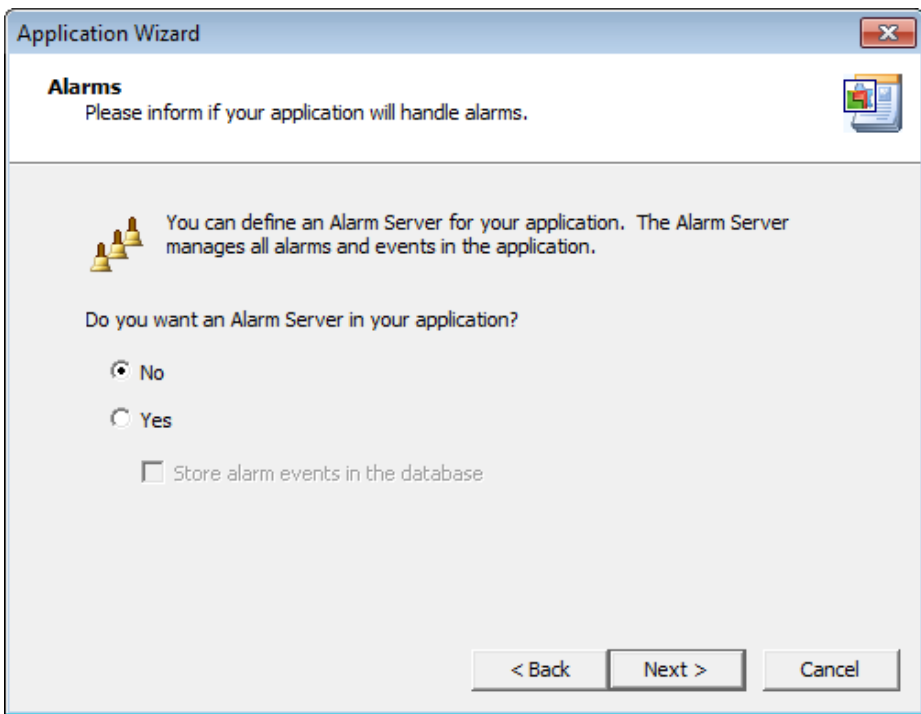


Database screen

Click **Next** to proceed.

3.8.1.6 Alarms

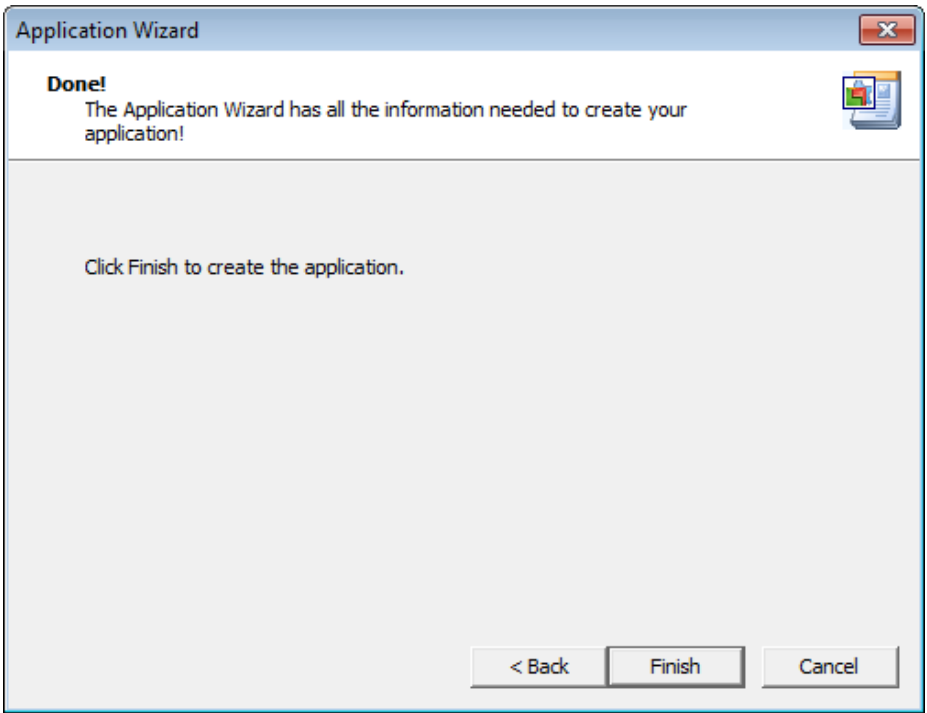
On this screen, users can add an Alarm Server and an Alarm Configuration object to this project. The **Store alarm events in the database** option enables users to store information regarding alarms on disk, as long as a Database had been added to this project.



Alarms screen

Click **Next** to proceed.

After that, the system displays the Wizard's final screen, with a message indicating the end of the process of creating an application.



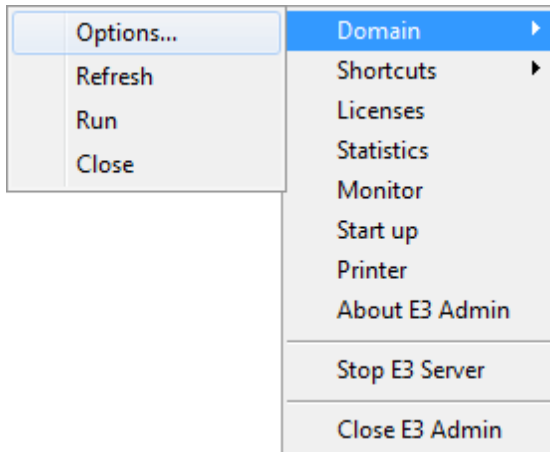
Application Wizard's final screen

End the process by clicking **Finish**.

3.9 Configuration

When using E3 Admin's contextual menu on Windows Notification Area, users can run, stop, refresh, or close a Domain directly with the **Run**, **Stop**, **Refresh**, and **Close** options, respectively.

In addition, a Domain can be also configured for redundancy and for Remote Domains, among other actions. These options can be configured via the **Domain - Options** menu.



Configuration options via Windows Notification Area

NOTE: The **Domain - Options** menu is not available in **Demo** mode, and the **Run** and **Stop** options are not available if a Domain is in **Hot-Standby** mode, or if it is open on a computer not belonging to the current Domain.

3.9.1 Options Tab

On **Options** tab, users can enable server redundancy.

The screenshot shows the 'E3 Admin - Domain Configuration' window with the 'Options' tab selected. The window has a menu bar with 'Options', 'Security', 'Viewer groups', 'Events recording', 'Projects', 'Servers', 'Remote Domains', and 'Properties'. The 'Options' tab contains several sections:

- Hot-StandBy**: Includes a checked 'Enable:' checkbox. Below it are two dropdown menus: 'Main server:' set to 'Main' and 'Backup server:' set to 'Backup'. There is an unchecked checkbox for 'Activate backup server on local failure' and a text area for 'PING addresses to check network integrity:'. A tip at the bottom states: 'Tip: Use blank space, tab, semicolon, comma or line break as separator'.
- Time to activate backup server**: Features a slider between 'Fast (1s)' and 'Slow (30s)', currently positioned at 'Switch-over in 15 seconds (ping = 2000ms)'. A note below reads: 'Using as faster as possible activation, more CPU and Network resources will be consumed and greater are the chances of unnecessary activations caused by network fluctuations.'
- Pre-activated services in backup server**: Includes a dropdown for 'Backup server pre-activation profile:' set to 'Custom'. Below it, a section 'Pre-activate the following services:' has checkboxes for 'Links' (unchecked), 'I/O drivers (no communication)' (unchecked), 'Scripts' (unchecked), and 'Database' (checked).

At the bottom right are 'OK', 'Cancel', and 'Apply' buttons.

Options tab

The available options on this tab are described on the next table.

Available options for Options tab


OPTION	DESCRIPTION
Hot-Standby	Enables the Hot-Standby mode. If disabled, a Domain is executed in the server it has been loaded, with no Hot-Standby support. If enabled, users can select a main server where a Domain executes and, optionally, a standby server.
Main Server	Selects the name of the main server to run a Domain. To register and configure servers, go to the Servers tab.

OPTION	DESCRIPTION
Backup Server	If enabled, selects a backup server to run a Domain. This server remains in standby, with the application loaded in E3Run ready to be executed if the main server fails, or if the backup server is manually activated.
PING addresses to check network integrity	<p>The Hot-Standby algorithm demands a third network entity (the other ones are the main and backup servers) to determine whether a network is working. If it is not possible to access neither the integrity address nor the backup server, the main server assumes that the network interface has problems and immediately terminates the Domain execution. This field allows registering multiple network addresses. The options for this field are the following:</p> <ul style="list-style-type: none"> • Separators allowed for each address are space, comma, semicolon, tab, and line break • If at least one of the addresses typed in this field returns success, then the network is considered without failures • Server names are case insensitive • Repeated names are discarded • Spaces before or after server names are trimmed
Activate backup server on local failure	Enables an automatic server switching when a local failure is reported in the main server. Local failures are detected and reported by an application using the Application.ReportFailure method. The server switching is only performed if the backup server has no failures.
Time to activate backup server	Indicates an activation time for the backup server. Default value is 15 seconds. This time directly affects the ping timeout among servers. If it is too low (switches every 1 second, ping timeout in 160 ms), there may be spontaneous server switches caused by small network failures.
Backup server pre-activation profile	<p>Presents the following pre-activation profiles available:</p> <ul style="list-style-type: none"> • Minimal: Activates only basic services • Maximum: E3 activates all available services when in standby (Links, I/O Drivers, scripts, and Databases) • Custom: Users can define which services are needed. Each option can be individually enabled or disabled

OPTION	DESCRIPTION
Pre-activate the following services	<p>Allows users to select services to activate (as long as the previous option was set to Custom):</p> <ul style="list-style-type: none"> • Links: Default value is disabled. If enabled, Links and XObjects Link-type properties are evaluated during standby activation • I/O Drivers (no communication): Default value is disabled. If enabled, IOServers are created during standby activation. NOTE: This option is important in applications with several I/O Drivers • Scripts: Default value is disabled. If enabled, all object and library event scripts are compiled and activated during standby activation • Database: Default value is enabled. This means that a Database is connected during standby activation. If disabled, it only prevents connection to a Database from being created during standby activation <p>This option is automatically enabled when the EnableSynchronization property is set to True.</p>

IMPORTANT: When a Domain starts executing, E3 Server always picks an active server alphabetically, regardless of this one being selected as main or backup. This criteria is used whenever more than one server is a candidate to execute a Domain. For further information, please check chapter **Hot-Standby**.

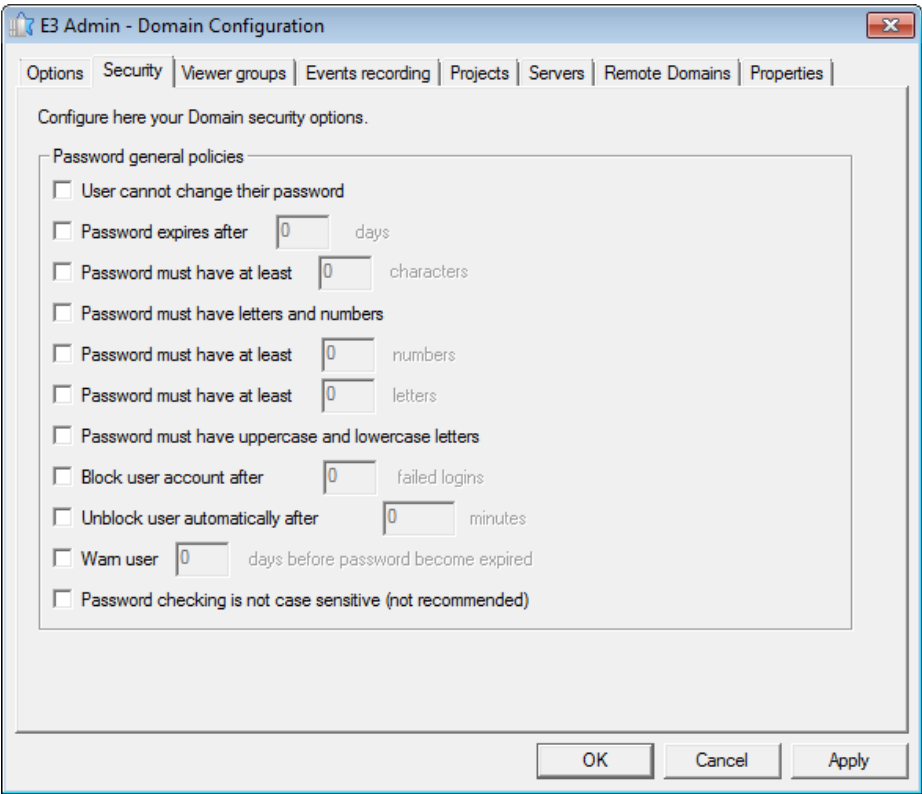
When Hot-Standby is turned on, the following procedures are necessary:

- Defining a shared network directory to contain the main copy of Domain files. This directory must be placed in a computer that is not part of the E3 Domain
- Creating a directory in every E3 Server where an updated copy of Domain files is kept. E3Run uses this local copy of PRJ and LIB files
- Always opening the same network DOM file, by using its network path (for example, \\server\folder\Domain.dom)
- When using E3 Studio, always editing the main copy of projects and libraries (the network copy). To apply changes, copy modified project and library files to the local directory of Domain servers. After that, click **Run Domain** , to apply these modifications at run time (E3Run)

NOTE: REDUNDANCY IS NOT AVAILABLE IN DEMO MODE. When the **Hot-Standby** mode is turned on, it is necessary that all servers have a copy of Domain files (.dom, .prj, and .lib), and the same directory tree.

3.9.2 Security Tab

When using the **Security** tab, users can determine Domain security configurations. This option is used as default, in case no security permission options for project's users are enabled. To open this item, right-click E3 Admin icon on Windows Notification Area, select **Domain - Options**, and click the **Security** tab. The window on the next figure is then displayed.



Security tab

The available options on this tab are described on the next table.

Available options for Security tab

OPTION	DESCRIPTION
User cannot change their password	Prevents users from changing their passwords at run time.

OPTION	DESCRIPTION
Password expires after ... days	Establishes user's password expiring date. Before password expires, the application warns users how many days are left to change it. After that period, if the password has not been changed, users are disabled.
Password must have at least ... characters	Establishes a minimum amount of characters for user's password.
Password must have letters and numbers	Establishes that passwords must contain letters and numbers.
Password must have at least ... numbers	Establishes a minimum amount of numbers for user's password.
Password must have at least ... letters	Establishes a minimum amount of letters for user's password.
Password must have uppercase and lowercase characters	Establishes that passwords must contain uppercase and lowercase characters.
Block user account after ... failed logins	Establishes a maximum amount of login failures tolerated by the application before blocking user's account.
Unblock user automatically after ... minutes	Unlocks user's account after a certain number of minutes.
Warn user... days before password become expired	Establishes a date for users to start receiving daily messages about password's expiring date. After that date, if users do not change their passwords, they are blocked, and only an Administrator can unblock them.
Password checking is not case sensitive	Allows password validation regardless of case sensitivity. This option is not recommended.

Password Blocking

User accounts can be blocked in the following situations:

- If their passwords expire (expiring date can be global, by group, or a single-user attribute)
- If users mistype their passwords a certain number of times in a row, that is, a login failures

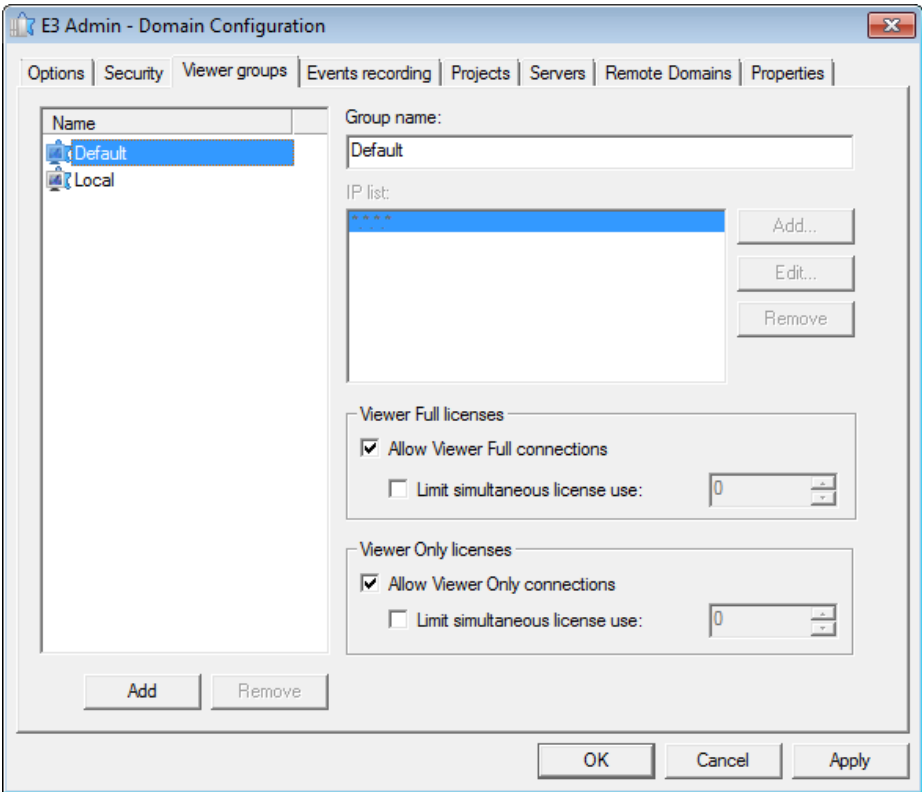
Once blocked, a user account does not allow login anymore. This condition remains until an Administrator manually unblocks that password, or until blocking timeout expires.

3.9.3 Viewer Groups Tab

Users can specify, according to Viewer's IP, if it can connect, and with which license type (**Viewer Full** or **Viewer Only**).

With this resource, users can completely block a connection, or limit the amount and type of licenses to use simultaneously by a certain group of IPs.

To access Viewer groups, right-click E3 Admin's icon on Windows Notification Area, select **Domain - Options**, and then **Viewer groups** tab. The window on the next figure is then displayed.



Viewer groups tab

The available options on this tab are described on the next table.

Available options for Viewer groups tab

OPTION	DESCRIPTION
Name	Lists names for all Viewer groups.
Add / Remove	Adds or removes Viewer groups.
Group name	Enables creating or changing Viewer group's names.

OPTION	DESCRIPTION
IP list	Specifies which IPs belong to a group, and thus share the same connection limits. When a Viewer tries to connect to an E3 Server, its IP address is compared to existent groups. After a group to which it belongs is determined, a license restriction configured to that group is <u>applied to this Viewer</u> .
Add / Edit / Remove	Adds, edits, or removes IP numbers. When a group is created, it has no specified IP (except for the first group, which is always *.*.* and cannot be created by a user). In case users try to save these settings, and a group has an empty IP list, the application then displays a warning message. In case a <u>group is kept that way, it is useless</u> .
Allow Viewer Full connections	When selected, it allows Viewer Full -type connections for this group.
Limit simultaneous license use	When selected, it limits using simultaneous Viewer Full -type licenses down to a certain number. If previous option is selected, but this one is not selected, using simultaneous licenses is unlimited.
Allow Viewer Only connections	When selected, it allows Viewer Only -type connections for this group.
Limit simultaneous license use	When selected, it limits using simultaneous Viewer Only -type licenses down to a certain number. If previous option is selected, but this one is not selected, using simultaneous licenses is unlimited.

Users must notice that these group limits are applied after E3 Server limits, as configured on a protection device. For example, if a protection device has ten Viewer licenses and a group specifies five connections, only these five licenses are used. However, if a protection device has five Viewer licenses and a group specifies ten connections, protection device's limit is obeyed, and only five connections are used.

Viewer group configurations should be performed preferably when a Domain is stopped. In case they are performed while a Domain is running, they have no effect until all Viewers are disconnected.

NOTE: In case of connections identified as **E3AccessLayer** and **E3DataAccess**, which by default do not consume licenses from an E3 Server, Viewer Groups' behavior is the following:

- If a Viewer Group does not allow **Viewer Full**- nor **Viewer Only**-type connections, then connection is denied
- If a Viewer Group allows **Viewer Full**-type connections, then connection is allowed and obeys the requested access type. For example, for **Viewer Only**-types a connection is read-only, and for **Viewer Full**-types a connection is for reading and writing
- If Viewer Groups allows only **Viewer Only**-type connections, then connection is allowed and read-only, even for **Viewer Full**-types

3.9.4 Events Recording Tab

There are two different event categories: **System Default** and **Manual** events.

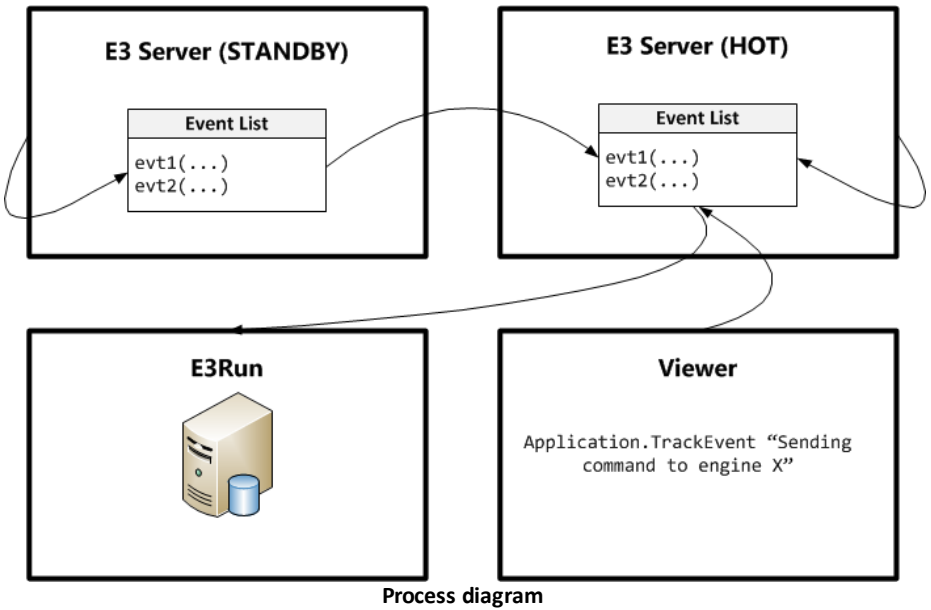
System Default Events are events automatically generated by E3, which may have their registration enabled or disabled individually:

- User login or logout
- User password change
- User login failure
- User database change
- User account blocking
- Domain start or stop
- Domain change (insert, remove, enable, and disable projects and libraries, change Domain configuration)
- Domain update (when users apply changes performed in projects via E3 Studio)
- Manual switching of a Hot-Standby server

Manual Events are application-defined events. These events are generated by user scripts, by using the **Application.TrackEvent** method. These events can be generated both in Viewer and in Server (E3Run).

Viewer is a manual event generator. Use the **Application.TrackEvent** method to send an event to E3 Server.

The diagram on the next figure shows how different E3 processes generate and handle system events.



Process diagram

Every E3 Server maintains an internal list of events to register on a Database. These events can come from three different sources:

- Events generated on Viewers (using the **Application.TrackEvent** method)
- Events generated internally by an E3 Server
- Events generated by a Standby E3 Server

The **E3 Server Standby** periodically sends an event list to the **E3 Server Hot**, because only this one is capable of recording events on a Database. Events are placed on **Hot**'s event queue, along with other system events. That is, the **Hot** server centralizes event recording.

If there is a server switching, events that were not recorded yet are automatically sent to the new **Hot** server.

E3Run stores on a database events sent by the **E3 Server Hot**. E3 Server then informs Data Server's name and table to store data.

To configure event recording in E3, right-click E3 Admin icon on Windows Notification Area, select **Domain - Options**, and then **Events recording** tab. The window on the next figure is then displayed.

E3 Admin - Domain Configuration

Options | Security | Viewer groups | **Events recording** | Projects | Servers | Remote Domains | Properties

☐ **Enable system events recording**

☒ Automatically select application database

☐ Use this database:

Table name:

Check below the events to be logged:

Event	Message
<input checked="" type="checkbox"/> User login	User '%USER%' has logged in %SESSION% in machine '%MACHINE%'
<input checked="" type="checkbox"/> User logout	User '%USER%' has finished his/her session of %SESSION% in machi...
<input checked="" type="checkbox"/> Password change	Password of user '%USER%' has changed
<input checked="" type="checkbox"/> Login fail	User login '%USER%' in %SESSION% in '%MACHINE%' failed: %CAU...
<input checked="" type="checkbox"/> User database change	User '%USER%' has changed user database
<input checked="" type="checkbox"/> Blocked account	User account '%USER%' has been blocked
<input checked="" type="checkbox"/> Domain started	Domain has been started by user '%USER%' in %SESSION% in machi...
<input checked="" type="checkbox"/> Domain closed	Domain has been closed by user '%USER%' in %SESSION% in machin...
<input checked="" type="checkbox"/> Domain updated	Domain has been updated by user '%USER%' in %SESSION% in mach...
<input checked="" type="checkbox"/> Domain changed	Domain has been changed by user '%USER%' in %SESSION% in mac...
<input checked="" type="checkbox"/> Manual server switch	Standby server activated by user '%USER%' in %SESSION% in machi...

Tip: press F2 to edit selected message event

OK Cancel Apply

Events recording tab

The available options for this tab are displayed on the next table.

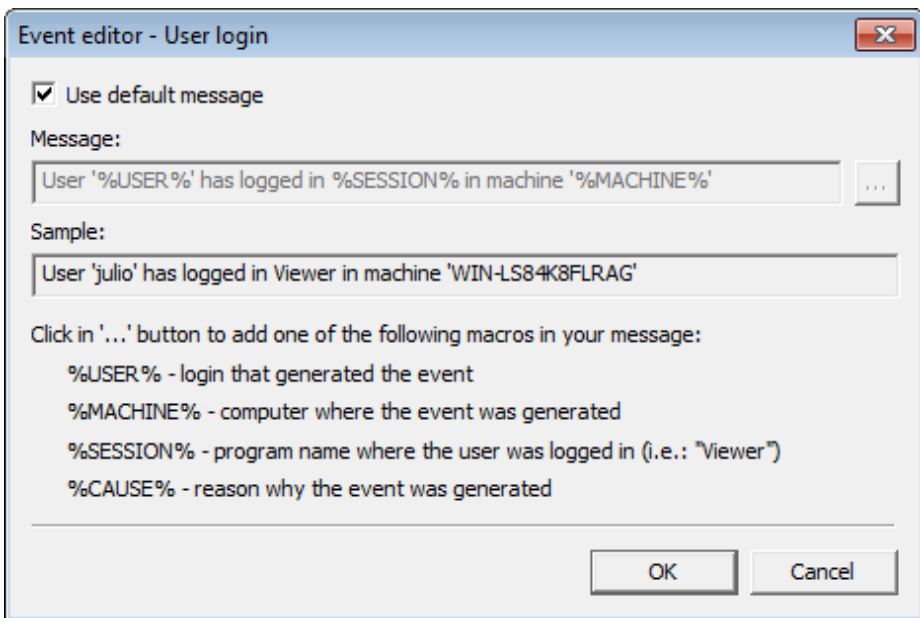
Available options for Events recording tab

OPTION	DESCRIPTION
Enable system events recording	Enables event recording in E3.
Automatically select application database	Enable this option to let E3Run pick up a Data Server to store data. If an application contains only one Data Server, this object is used. If there is more than one, it is recommended to use the Use this database option.
Use this database	Enable this option to specify a Data Server where events are stored. If Data Server's name is informed incorrectly, all events are stored on E3 Server's event queue (in memory), until a valid Data Server be indicated.


OPTION	DESCRIPTION
Table name	<p>Indicates a table where events are stored. This table is created automatically by E3Run, with the following fields:</p> <ul style="list-style-type: none"> • E3TimeStamp (Date/Time): The E3TimeStamp field is configured by E3Run and contains the date and time when E3Run sent that event to the Database • EventTime (Date/Time): The EventTime field contains the date and time this event happened, current server's (Hot or Standby) date and time when this event was created, or else the <i>dtTimeStamp</i> parameter specified by the Application.TrackEvent method • EventMessage (String): event message (maximum of 200 characters) • EventComment (String): comment about this event (maximum of 200 characters)
Check below the events to be logged	Lists all available events in an application for storage.

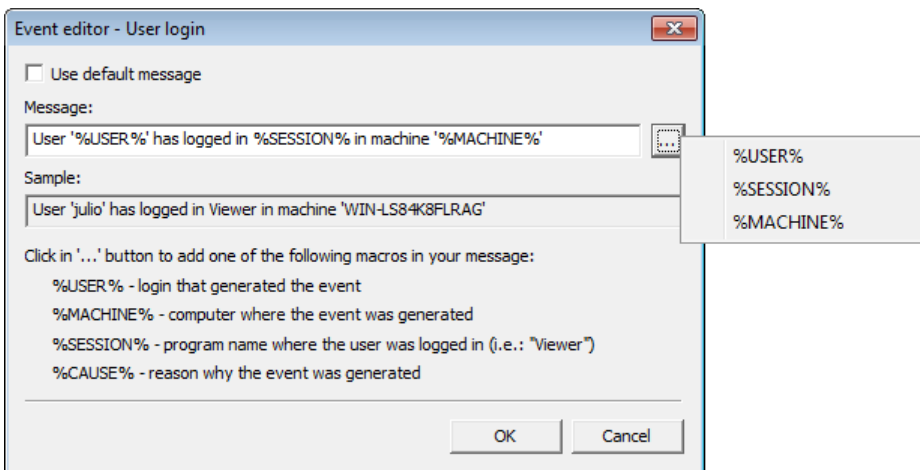
If E3Run must choose among several Data Servers, usually the first one to be activated during Domain execution is the chosen one. If during Domain execution users disable the project containing the Data Server used to store events, E3Run automatically picks up another Data Server available in the application, and uses this one until the previous Data Server be re-activated. This implies in the possibility of some events being stored in one Data Server, whereas other events being stored in another Data Server, when there is more than one Data Server in a project (that is why it is recommended that a specific Data Server be indicated, when there is more than one Data Server in a project).

When an event is selected on the list, and the F2 key is then pressed, a dialog box for editing that event is opened. The window on the next figure is then displayed.



Event editor

Deselect the **Use default message** option to change event's message. Click  to insert a macro inside the current message. Only macros allowed for that event are displayed.



Available macros for the current event

Macros always have the format **%MACRO%**. The following macros can be used:

- **%%**: Inserts a percent sign in the message
- **%USER%**: Inserts the name of the user generating this event (or "Anonymous",

if there is no user logged in)

- **%MACHINE%**: Inserts the name of the machine where this event was generated
- **%SESSION%**: Inserts the name of the program where the user was logged in (Viewer, Studio, or E3 Server)
- **%CAUSE%**: Additional information about this event

For example, if a **Login Failure** event message is changed to:

```
"%USER% user login has failed at computer %MACHINE% (using a %SESSION%): %CAUSE%"
```

If the Admin user mistype the password while logging to Viewer, which is running on the machine CLIENT004, the following event is then generated:

```
"Admin user login has failed at computer CLIENT004 (using a Viewer): login or password incorrect"
```

Default system events are explained on the next sections.

3.9.4.1 User Login

User %USER% has logged in %SESSION% in machine %MACHINE%

Generated whenever a successful user login occurs either on E3 Studio or on Viewer, where:

- **%USER%** contains the user's login name
- **%SESSION%** contains "Viewer" or "Studio"
- **%MACHINE%** contains the name of the computer where this user is logged in

3.9.4.2 User Logout

User %USER% has finished their session of %SESSION% in machine %MACHINE%

Generated whenever a user logout occurs either on E3 Studio or on Viewer (or whenever a program is closed without a logout. In this case, this logout is automatic), where:

- **%USER%** contains the user's login name
- **%SESSION%** contains "Viewer" or "Studio"
- **%MACHINE%** contains the name of the computer where this user was logged in

3.9.4.3 Password Change

Password of user %USER% has changed

Generated whenever a user's password changes (by using Viewer's **ChangePassword** method), where:

- **%USER%** contains the user's login name that had their password changed

3.9.4.4 Login Fail

User login %USER% in %SESSION% in %MACHINE% failed: %CAUSE%

Generated whenever a user login fails either on Viewer or on E3 Studio, where:

- **%USER%** contains the user's login name
- **%SESSION%** contains "Viewer" or "Studio"
- **%MACHINE%** contains the name of the computer where this user tried to log in
- **%CAUSE%** might be an incorrect login or password, a disabled account, a blocked account, an expired password, or a *0xnntnnnnn* error

3.9.4.5 User Database Change

User %USER% has changed user database

Generated whenever a user database changes (usually via E3 Studio's **File - Users** menu), where:

- **%USER%** contains the user's login name who edited user's database (or "Anonymous" if there were no users logged in)

3.9.4.6 Blocked Account

User account %USER% has been blocked

Generated whenever a user's account is blocked due to an excessive number of wrong logins, where:

- **%USER%** contains the user's login name whose account was blocked

3.9.4.7 Domain Started

Domain has been started by user %USER% in %SESSION% in machine %MACHINE%

Generated whenever a Domain starts (executes), where:

- **%USER%** contains the user's login name who executed this Domain (or "Anonymous" if no authentication was requested when this Domain was

executed)

- **%SESSION%** contains "Studio" or "E3 Server" (menu on Windows Notification Area)
- **%MACHINE%** contains the name of the computer where the command to execute this Domain was generated

3.9.4.8 Domain Closed


Domain has been closed by user %USER% in %SESSION% in machine %MACHINE%

Generated whenever a Domain stops, where:

- **%USER%** contains the user's login name who stopped this Domain (or "Anonymous" if no authentication was requested when this Domain stopped)
- **%SESSION%** contains "Studio" or "E3 Server" (menu on Windows Notification Area)
- **%MACHINE%** contains the name of the computer where the command to stop this Domain was generated

3.9.4.9 Domain Updated

Domain has been updated by user %USER% in %SESSION% in machine %MACHINE%

Generated whenever a Domain is updated by clicking  on E3 Studio, that is, whenever changes performed on PRJ and LIB files are applied on E3Run, where:

- **%USER%** contains the user's login name who logged in E3 Studio (or "Anonymous", if no user is logged in)
- **%SESSION%** contains "Studio"
- **%MACHINE%** contains the name of the computer where E3 Studio was running

3.9.4.10 Domain Changed

**Domain has been changed by user %USER% in %SESSION% in machine %MACHINE%:
%CAUSE%**

Generated whenever a Domain file (.dom) is modified, where:

- **%USER%** contains the user's login name who changed this Domain
- **%SESSION%** contains "Studio" or "E3 Server"
- **%MACHINE%** contains the name of the computer where the command to change this Domain was generated
- **%CAUSE%** might be:

- Changes were applied to the computer editing this Domain
- Project "projectname" was added (enabled)
- Project "projectname" was added (disabled)
- Project "projectname" was removed
- Project "projectname" was disabled

3.9.4.11 Manual Server Switch

Standby server activated by user %USER% in %SESSION% in machine %MACHINE%

Generated whenever a Domain's backup server activation is forced, via E3 Server's **Server - Activate** menu, where:

- **%USER%** contains the user's login name who activated the backup server (or "Anonymous" if no authentication was requested when that server was activated)
- **%SESSION%** contains "E3 Server" (menu on Windows Notification Area)
- **%MACHINE%** contains the name of the computer where the command to activate the backup server was generated

3.9.5 Projects Tab

Users can add, remove, or edit projects (.prj files) of a Domain. To open this item, right-click the E3 Admin icon on Windows Notification Area, select **Domain - Options**, and then **Projects** tab. The window on the next figure is then displayed.



The screenshot shows the 'E3 Admin - Domain Configuration' window with the 'Projects' tab selected. The 'Name' list on the left contains 'project1.prj'. The 'Project name:' text box on the right also contains 'project1.prj'. At the bottom left are 'Add' and 'Remove' buttons. At the bottom right are 'OK', 'Cancel', and 'Apply' buttons. A checkbox labeled 'Maintenance mode (disabled)' is located below the project list.

Projects tab



The available options on this tab are described on the next table.

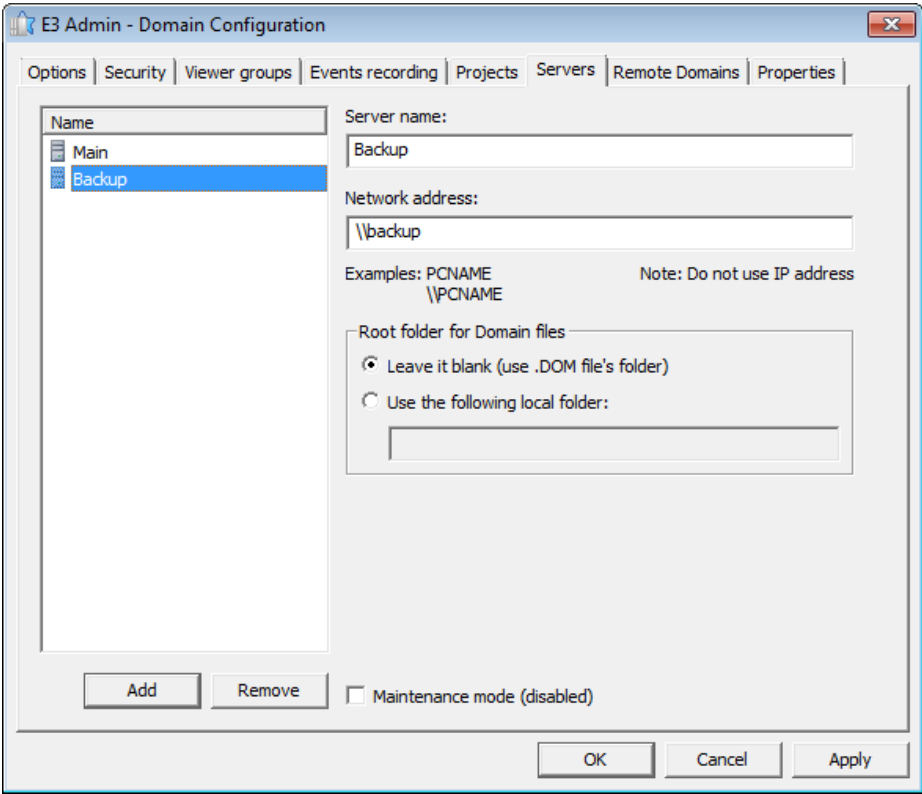
Available options for Projects tab

OPTION	DESCRIPTION
Name	This option lists all names of projects in an application.
Add / Remove	By using these options, it is possible to remove or add projects in an application. To add a project, click Add , and then fill in the Project Name field. To remove a project, select it and then click Remove . The PRJ file is not deleted from disk, only from Domain's project list.
Project Name	Type the name of the project file, which must be a path relative to Domain's directory (the directory containing .dom files). Example: Screens.prj, Hydro \Station1.prj.

OPTION	DESCRIPTION
Maintenance mode (disabled)	This option allows disabling project's execution, thus avoiding errors when the Domain is executed. When this option is enabled, the icon  indicates that this project is not used. Projects displaying an icon  are enabled and are executed.

3.9.6 Servers Tab



Users can add, remove, or edit servers from a Domain. Use the list on the left to select one or more servers to change. This list also indicates whether a server is enabled , in **Maintenance** mode, or disabled . To open this item, right-click the E3 Admin icon on Windows Notification Area, select **Domain - Options**, and then the **Servers** tab. The window on the next figure is then displayed.



Servers tab

The available options on this tab are described on the next table.

Available options for Servers tab

OPTION	DESCRIPTION
Name	List with all servers available.
Add and Remove	By using this option, users can add or remove servers. To add a network server, click Add and specify the Server Name and Network Address fields. To add a local server, specify the Use the following local folder option. To remove a project, select it and click Remove .
Server name	Determines the server's name. This is a user-defined name.
Network address	Inform this server's name on the network. This must be a machine's name with or without double backslashes at the beginning (for example, \\server or server).
Root folder for Domain files	Indicates a folder where Domain files (.prj, .lib, etc.) from the selected server are located. The Leave it blank (Use .DOM file's folder) option is default and indicates that files are on the same folder of the Domain file (.dom). If users select the Use the following local folder option, the path typed in that specific field must only contain a folder, without Domain's file name or extension (.dom).
Maintenance mode (disabled)	This option allows disabling a server, thus not using it when executing the Domain. When this option is enabled, the icon  indicates that this server is not used. Otherwise, the icon  indicates that this server can be used.

3.9.7 Remote Domains Tab

This tab allows adding, removing, or editing Remote Domains. Use the list on the left to select one or more servers to change. To open this item, right-click the E3 Admin icon on Windows Notification Area, select the **Domain - Options** option, and click **Remote Domains** tab. The window on the next figure is displayed.

The screenshot shows the 'E3 Admin - Domain Configuration' window with the 'Remote Domains' tab selected. The window has a menu bar with 'Options', 'Security', 'Viewer groups', 'Events recording', 'Projects', 'Servers', 'Remote Domains', and 'Properties'. On the left, a list box contains 'Remote 1'. Below it are 'Add' and 'Remove' buttons. On the right, the 'Name' field is set to 'Remote 1'. Below it is the 'Domain File' field with a browse button. The 'Servers and connection options' section has 'Main server' and 'Backup server' checkboxes, with 'Main server' selected. Below these are example text strings: 'PCNAME' and '\\PCNAME'. A 'Note' states 'Do not use IP address'. An 'Advanced...' button is also present. The 'Domain user' section has two radio buttons: 'Don't specify (anonymous)' (selected) and 'Use the following account'. Below these are 'User' and 'Password' input fields. At the bottom right are 'OK', 'Cancel', and 'Apply' buttons.

Remote Domains tab

The available options on this tab are described on the next table.

Available options for Remote Domains tab

OPTION	DESCRIPTION
Name	This options lists the names of Remote Domains in the system.
Add / Remove	By using these options, users can add or remove Remote Domains in the system. To add a Remote Domain on a network, click Add and then specify the Name and Domain File fields. To remove a Domain, select it on the list and then click Remove .
Name	Determines the name of the Remote Domain. This is a user-defined name.
Domain File	Determines the name or network path where the Remote Domain's .dom file is located.
Main server	Identifies the main server on the network.

OPTION	DESCRIPTION
Backup server	When enabled, identifies the backup server on the network.
Domain user	Allows recognizing a user with password for each Remote Domain. The available options are: Don't specify (anonymous) and Use the following account . By selecting the second option, the User and Password fields are enabled.
User	Identifies a user.
Password	Allows connecting to a Domain using a password.

It is possible that a Remote Domain configuration provides a way to connect to the local Domain itself. This is called a **Local Alias** or a **Loopback** connection.

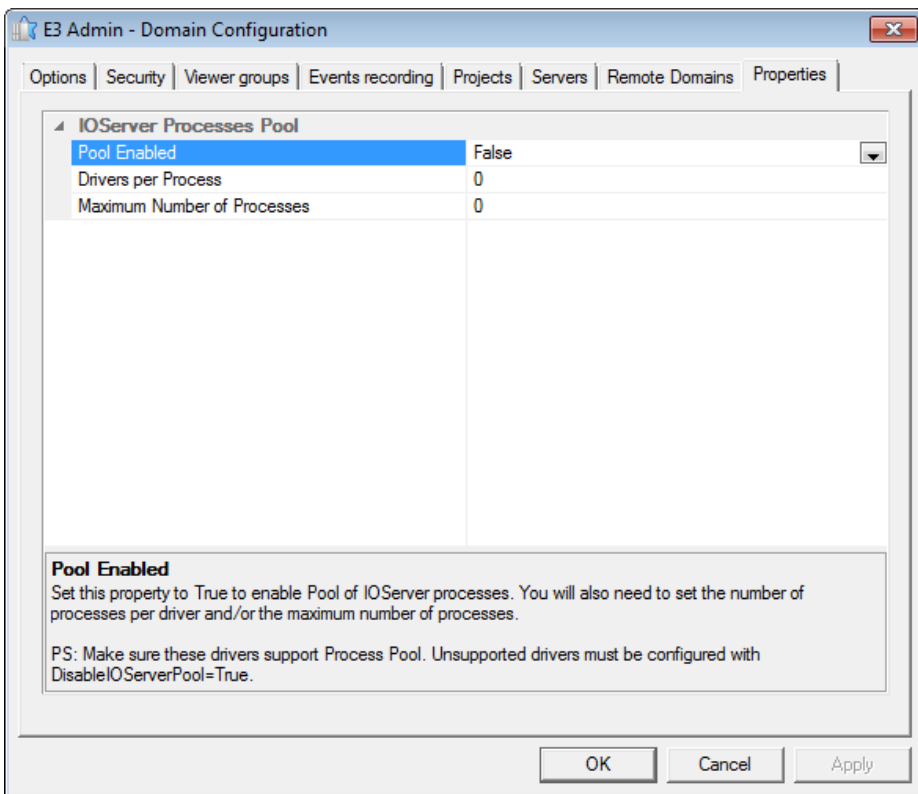
This alias is created according to a regular Remote Domain configuration. It is enough that server names (main and backup) be **localhost*** or the same name as the machine where the Domain is executing so that it works locally. In this case, for this configuration to work on E3 Studio, in the **Domain File** field inform the local path of the DOM file (for example, c:\path\file.dom).

NOTES:

- Changing local aliases with a Domain executing **IS NOT** supported. What happens is that, if the Domain is executing, Links already resolved as local always remain local, even if the alias is reconfigured to actually connect to a remote machine. To bypass this situation, restart the Domain
- Loopback connections are not shown on E3 Admin's **Licenses** window (or **Statistics**), nor need Remote Domain licenses to work
- * For the **localhost** name to work, it must be configured to point to IP address **127.0.0.1** (which is Windows default configuration)
- For more information about **Remote Domains** tab configuration, please check item **Connection Configurations**

3.9.8 Properties Tab

Allows controlling various Domain configurations. To open this item, right-click the E3 Admin icon on Windows Notification Area, select the **Domain - Options** option, and click the **Properties** tab. The window on the next figure is then displayed.



Properties tab


The available options on this tab are described on the next table.

Available options on Properties tab

OPTION	DESCRIPTION
Pool Enabled	Enables or disables IOServer's process pool. NOTE: Be sure that all Drivers in use in the application support this process pool feature (Drivers must be compiled with IOKit version 2.0.6 or newer). Drivers that do not support this feature must be configured with their DisableIOServerPool property in True. Default value for this option is False.
Drivers per Process	Defines the maximum number of Drivers that execute on each IOServer process. NOTE: This limit can be exceeded if the number of processes in this pool reaches the maximum configured in the Maximum Number of Processes option. Default value for this option is 0 (zero).

OPTION	DESCRIPTION
Maximum Number of Processes	Defines the maximum number of IO Server processes that are created by this pool. The value 0 (zero, default) for this option allows an unlimited number of processes.

This configuration can be changed while a Domain is executing, but it only affects Drivers started after that change, or on the following situations where the Domain is updated:

- By clicking  in E3 Studio
- By selecting the **Domain - Refresh** option on E3 Admin menu on Windows Notification Area
- By generating an event that forces E3Run to receive the Domain configuration

NOTE: For more information, please check the topic **Pool of IO Server Processes** on chapter **Drivers**.

3.10 Other Options for Windows Notification Area

In addition to the options listed on the previous sections, there are other configurations available via E3 Admin's contextual menu on Windows Notification Area.

3.10.1 Shortcuts

This option allows executing applications installed with E3 via E3 Admin's contextual menu on Windows Notification Area. The following applications can be executed:

- **Log Viewer**
- **E3 Studio**
- **E3 Tweak**
- **E3 Viewer**

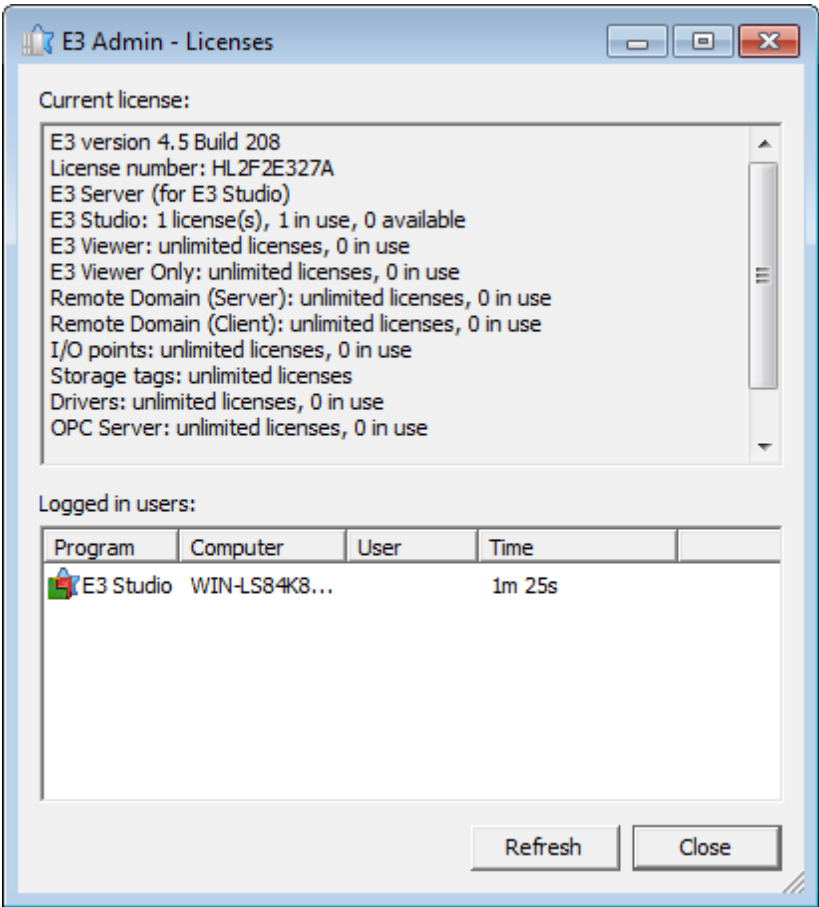
The **Log Viewer** item opens **Elipse Event Log Viewer**, already with the file corresponding to the active E3 log session. For more information about this application, please check **Elipse Event Log User's Manual**, available via **Start - Programs - Elipse Software - Elipse Event Log** menu.

If there is a Domain already executing locally, the **E3 Viewer** item on this menu opens a Viewer to the local Domain. Otherwise, or if the SHIFT key is pressed, opens

Viewer's initial screen, where users can select the server and other options, as described on topic **E3 Viewer and E3 WebViewer - Running E3 Viewer - Via Start Menu**.

3.10.2 Licenses

Users can view the available licenses via E3 Admin. To do so, right-click E3 Admin's icon on Windows Notification Area, and then select the **Licenses** option. The window on the next figure is then shown.



E3 Admin - Licenses window

The available options on this window are described on the next table.

Available options for E3 Admin - Licenses window

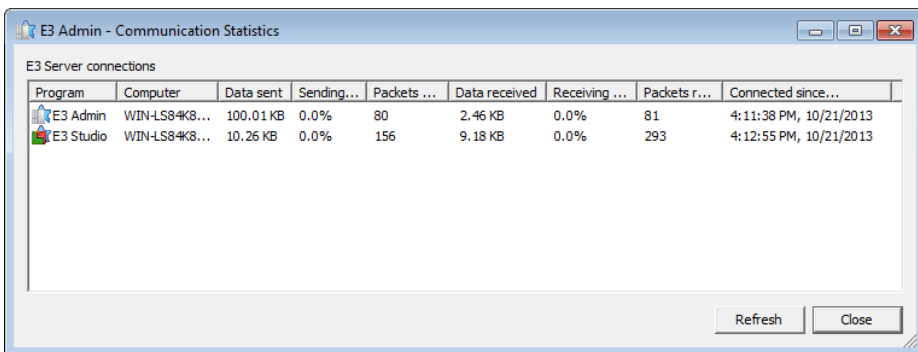
OPTION	DESCRIPTION
License number	Informs the license number (protection device): an eight-digit hexadecimal number with an "HL" prefix, if the device is a hard key; or a sixteen-digit hexadecimal number with an "SL" prefix, if the device is a soft key. If no protection device is detected, then this number is filled with zeroes.
E3 Server	Indicates the type of E3 Server.
E3 Studio	Indicates the number of available and in use E3 Studio licenses.
E3 Viewer	Indicates the number of available and in use E3 Viewer licenses.
E3 Viewer Only	Indicates the number of available and in use E3 Viewer licenses in Read-Only mode.
Remote Domain (Server)	Indicates the number of available and in use Remote Domain (Server) licenses.
Remote Domain (Client)	Indicates the number of available and in use Remote Domain (Client) licenses.
I/O points	Indicates the number of I/O points.
Storage tags	Indicates the number of Storage Tags.
Drivers	Indicates the number of available and in use Drivers.
OPC Server	Indicates the number of available and in use OPC Server licenses.
Maximum execution time	Indicates the maximum allowed execution time for an application.

For more information about E3's **Demo** mode limitations, please check topic **Limitations of Demonstration Mode**.

NOTE: Users logged in and identified as **E3DataAccess** and **E3AccessLayer**, the **Program** column on the **Logged in users** list, do not consume Viewer licenses from an E3 Server.

3.10.3 Statistics

The **E3 Admin - Communication Statistics** window shows real-time data about network information traffic. This list is automatically updated every second. To do so, right-click the E3 Admin icon on Windows Notification Area, and then select the **Statistics** option.



E3 Admin - Communication Statistics window

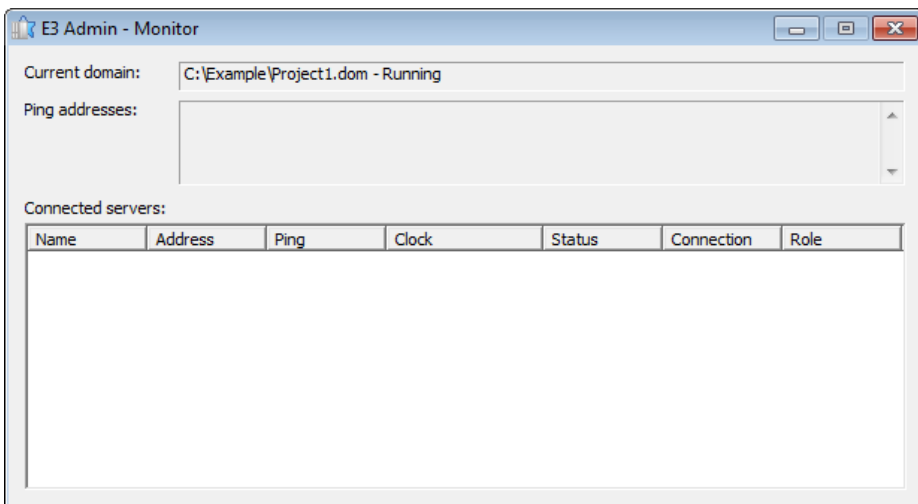
The available options on this window are described on the next table.

Available options for E3 Admin - Communication Statistics window

OPTION	DESCRIPTION
Program	Shows the name of the application connected to the E3 Server.
Computer	Shows the name of the machine connected to the E3 Server.
Data sent	Shows the amount of data sent.
Sending compression	Shows the percentage of compression on sending.
Packages sent	Shows the amount of packages sent.
Data received	Shows the amount of data received.
Receiving compression	Shows the percentage of compression on receiving.
Packages received	Shows the amount of packages received.
Connected since	Shows the date and time when the program started the connection.

3.10.4 Monitor

The **E3 Admin - Monitor** window shows real-time information about the status of Domain servers. To do so, right-click the E3 Admin icon on Windows Notification Area, and then select the **Monitor** option.



E3 Admin - Monitor window

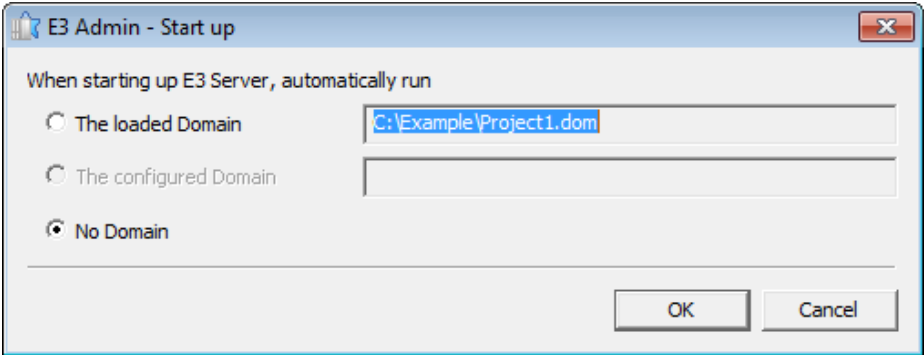
The available options on this window are described on the next table.

Available options for E3 Admin - Monitor window

OPTION	DESCRIPTION
Current domain	Name of the active Domain.
Ping addresses	List with all ping server addresses.
Name	Server's name.
Address	Server's network address.
Ping	Shows network ping status with this server.
Clock	Shows server's local time.
State	Shows Domain status on the server (Stopped or Running).
Connection	Shows the status of the DCOM connection with the server.
Role	Shows a list of functions reported by the server: <ul style="list-style-type: none"> • Active: This is the Domain's active server • Standby: This is the Domain's standby server • Failure(n):The server has local failures reported • Priority: The server requested priority to run the Domain. This indication forces the active server to switch to Standby mode • Candidate: The server is a candidate to run the Domain • E/S: The server has active IOServers

3.10.5 Start Up

The **E3 Admin - Start up** window allows users to control the Domain to start automatically. The configured Domain is only executed if this E3 Server is not in **Demo** mode. To do so, right-click the E3 Admin icon on Windows Notification Area, and then select the **Start up** option. The window on the next figure is then displayed.



E3 Admin - Start up window

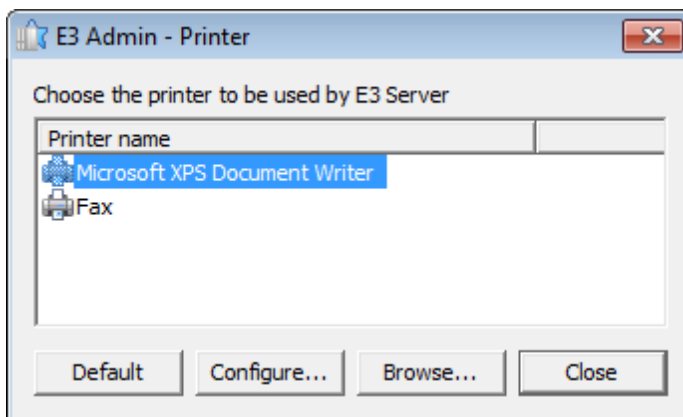
The available options on this window are described on the next table.

Available options for E3 Admin - Start up window

OPTION	DESCRIPTION
The loaded Domain	When starting up, automatically executes the previously loaded Domain.
The configured Domain	When starting up, automatically executes a user-configured Domain.
No Domain	Does not start any Domain.

3.10.6 Printer

This option displays a list of printers found either locally or remotely, and allows users to select one of them to use by an E3 Server. To do so, right-click the E3 Admin icon on Windows Notification Area and select the **Printer** option. The window on the next table is then shown.



E3 Admin - Printer window

The available options on this window are described on the next table.

Available options for E3 Admin - Printer window

OPTION	DESCRIPTION
Printer name	Lists the names of available printers.
Default	Allows selecting this printer as the default one.
Configure	Opens the property window of the selected printer.
Browse	Allows selecting another network printer and establishing a connection.

3.10.7 About E3 Admin

This option shows the current version of E3 Admin.

3.10.8 Start or Stop E3 Server

This option starts or stops the E3 Server. When the **Stop E3 Server** option is selected, users are asked to confirm this operation. If confirmed, the Domain is stopped and closed, and all existing E3 Studios and Viewers are disconnected (if there are any). Users are notified that this turns remote E3 Studios and Hot-Standby unavailable. When an E3 Server is stopped, it can be restarted via **Start E3 Server** option.

3.10.9 Close E3 Admin

E3 Admin can be closed without closing E3 Server, via **Close E3 Admin** option. When this happens, E3 Server continues executing, but no icon appears on Windows Notification Area. In this case, when E3 Admin is not open, error messages appear as message boxes to all users logged in (and active) on the machine running that E3 Server.

At any time, E3 Admin can be restarted to control the E3 Server currently executing, by simply starting E3 Admin without parameters. The installer also creates a shortcut to open E3 Admin directly.

3.11 Remote Domains

A Remote Domain configuration establishes that different servers and Viewers can communicate, where one application provides data and the other application receives it. The Domain providing data is called the **Server Domain**; The Domain using that data is called the **Client Domain**. A Domain configured as a Client Domain can also work as a Server Domain, and vice-versa. Remote Domains are not available in **Demo** mode.

3.11.1 Connection Configuration

Configuring connections with other E3 Domains is performed on the Client Domain, by right-clicking E3 Admin icon on Windows Notification Area, selecting the **Domain - Options** option, and then selecting the **Remote Domains** tab.

The screenshot shows the 'E3 Admin - Domain Configuration' window with the 'Remote Domains' tab selected. The window has a list of domains on the left with 'Remote1' selected. The right pane contains configuration fields for the selected domain. The 'Name' field is 'Remote1'. The 'Domain File' field is empty with a browse button. Below is a section for 'Servers and connection options' with 'Main server' and 'Backup server' fields, and an 'Advanced...' button. At the bottom is a 'Domain user' section with radio buttons for 'Don't specify (anonymous)' (selected) and 'Use the following account', followed by 'User' and 'Password' fields. 'Add' and 'Remove' buttons are at the bottom left, and 'OK', 'Cancel', and 'Apply' buttons are at the bottom right.

Name
Remote1

Name: Remote1

Domain File: [Browse]

Servers and connection options

Main server: [] Backup server: []

Examples: PCNAME \\PCNAME Note: Do not use IP address

Advanced...

Domain user

☒ Don't specify (anonymous)

☐ Use the following account

User: []

Password: []

Add Remove

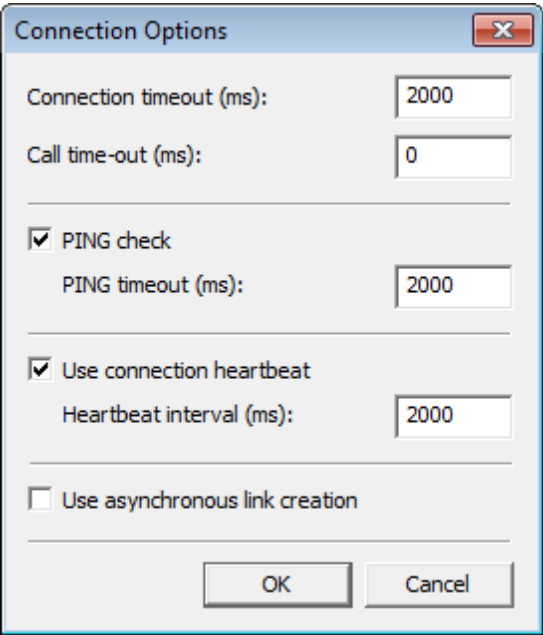
OK Cancel Apply

Remote Domains tab

In this case, the Domain referenced by this configuration is the Server Domain. Users can also have Domains referencing each other, playing the role of both server and client for Remote Domains. To configure a Remote Domain, follow these procedures:

1. Type an alias for the Remote Domain in the **Name** field. This field is not case sensitive. This name is used in an application to refer to objects accessed on the Remote Domain.
2. Specify the path of the .dom file of the Remote Domain. This path must be a network sharing that allows access to this .dom file.
3. Inform the name of the main server, which must be the server containing the Remote Domain specified by the .dom file path. This configuration is used to find Remote Domain objects at run time.

The **Servers and connection options** item contains an **Advanced** option, which allows performing specific connection configurations among Domains, using the window displayed on the next figure.



Connection Options window

The options on this window are described on the next table.

Available options on Connection Options window

OPTION	DESCRIPTION
Connection timeout (ms)	This options controls the maximum time that a Client Remote Domain waits to establish a REC connection with the E3 Server of the Server Domain. Its goal is the same as the ConnectionTimeout key, configurable using E3 Tweak . Default value for this option is 2000 ms.
Call time-out (ms)	This option controls the maximum time a Client Remote Domain waits for the return from a call to a Server Domain. If this time is exceeded, this connection is closed by the client, even if the limits established by the PING check and Use connection heartbeat options is not exceeded yet. Default value for this option is 0 (zero), which disables this limit time.
PING check	This option allows that, using an ICMP protocol echo request, a Remote Domain checks if the Server replies within a time-out. If there is no answer, for any reason, that computer is considered as offline, or turned off. This check, if enabled, occurs before the connection (avoiding an attempt to connect to an unavailable computer) and while the connection is active (forcing an immediate disconnection).
PING timeout (ms)	Value, in milliseconds, for a ping check. Default value for this option is 2000 ms.
Use connection heartbeat	This option allows that, using a REC protocol mechanism, the Client Remote Domain checks if the Server keeps the connection alive, waiting for periodic heartbeat messages to be sent, even if there is no other communication to perform. If double the time of the configured heartbeat is exceeded, with the Client not receiving any message from the Server, then the Server is considered on failure or offline, forcing an immediate disconnection.
Heartbeat interval (ms)	Value, in milliseconds, of the heartbeat interval. Default value for this option is 2000 ms.

OPTION	DESCRIPTION
Use asynchronous link creation	If this option is selected, Links are created in parallel among several Domains and the result of that operation is sent asynchronously, as each Server replies. The advantage of this option is that it does not lock E3 Server's general Link handling. Only operations of that same Domain can be locked if the Link creation lasts too long (which can happen on slow networks). NOTE: This option is not available for versions prior to 3.2, and applications developed in previous versions fail with an error code 8004F108 (incompatible REC version). Default value for this option is not selected, which corresponds to the behavior of versions prior to 3.2.

NOTE: Deselecting the **PING check** and **Use connection heartbeat** options simultaneously makes detecting connection failures extremely slow, in case the Server fails. It is recommended that these two options always remain selected.

In E3 Studio, the full sharing path is used to determine existing objects in the Remote Domain. The name of the .dom file (without the path) is used to check whether remote connection is being performed with the right Domain, at run time. Thus, if the name of the Domain loaded in the remote E3 Server is not correct, the connection will not be completed and the remote objects will not be available.

Another possibility is to keep a copy of the Remote Domain on the Client machine, and type the path of that copy in the **Domain File** field. Hence, E3 Studio will then use that local copy to determine which objects exist, allowing offline work. This copy must have the same name of the Remote Domain for this connection to work, but it is not necessary to have the same directory hierarchy.

In addition, for a connection among Domains, all E3 Servers involved must run the same E3 version. It is not possible, for example, connect to a Domain running E3 version 2.5.

To enable an E3 Server to accept connections from other Domains (that is, to work as a Remote Domain server), no further configuration is needed.

After correctly configuring these items, just run all E3 Servers to establish remote connections.

NOTE: For more information about Remote Domain configuration, please check topic **Domain Configuration - Remote Domains**.

3.11.2 Licenses

Both the E3 Server running the Client Domain, and the one running the Server Domain must have specific licenses for Remote Domains.

When this license exists, the E3 Server running as Server starts accepting an unlimited number of external connections from other Domains. Likewise, in the E3 Server running as a Client, an unlimited number of connections is established. For more information about limitations of E3's **Demo** mode, see topic **Limitations of Demonstration Mode**.

3.11.3 Link Syntax

With a Remote Domain configuration, the Client Domain can access objects from the Server Domain in two different ways: Via scripts, by using the **Application.GetObject** method; or via Links, that is, any functionality that creates a connection to another object (user event expressions, **ElipseX Object**-type properties, Link sources, Alarms, or fields in Historic or Storage objects, among others). Objects accessed this way can be either Viewer or Server objects.

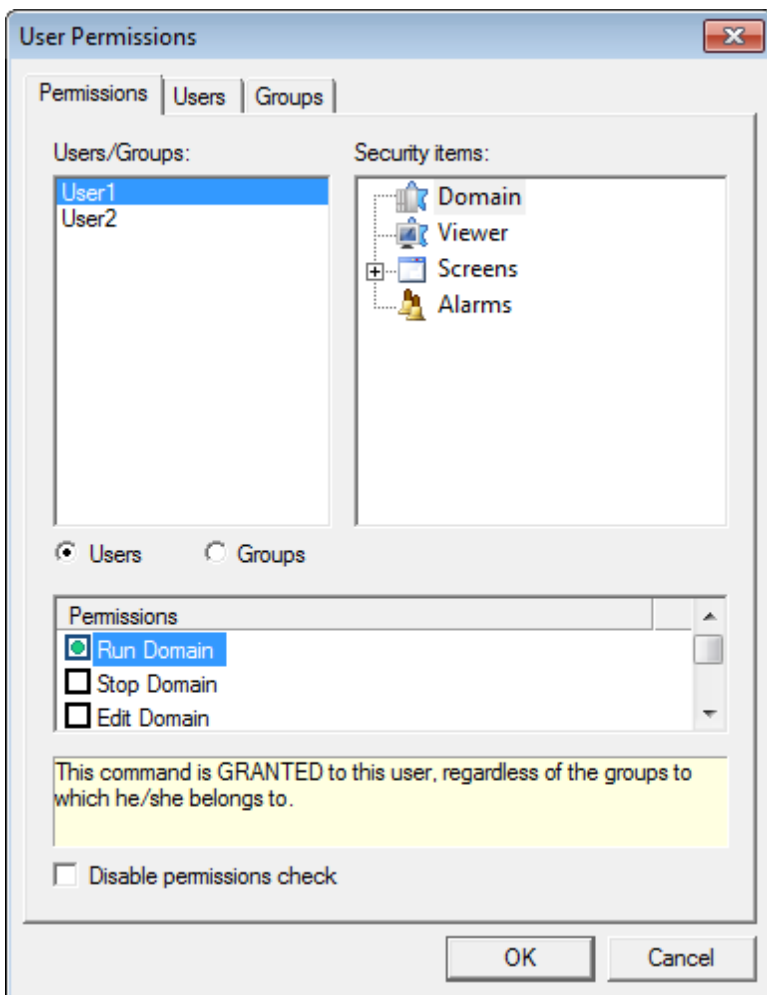
Access to objects from other Domains is performed via alias (Domain Name), which must precede each object's complete path, separated by a colon. That is, for Link sources or an **Application.GetObject** method to reference another Domain, users must use a **DOMAIN:PATH** syntax, where **DOMAIN** is the alias given to that Remote Domain connection, and **PATH** is the complete path of an object or property from that Domain. In case of Links, sources may include expressions referring to several objects, with possible combinations between local objects and Remote Domains. For example, **Driver1.Tag1 + Remote:Driver2.Tag1 * 2**.

Remote Domain's name may also need brackets, such as **[DOMAIN]:PATH**. In this case, the same rules applied for naming objects are valid. A Domain name needs brackets if it:

- Starts with a character that is not a letter (with no diacritical marks nor "`ç`")
- Contains any character that is not a letter (with no diacritical marks nor "`ç`"), a number (0-9), nor an underscore

3.11.4 User Permissions

Similar to what happens with Viewer, access to objects from a Remote Domain can be limited to a **Read-Only** mode. Whenever this situation occurs, the same type of access limitations applied to a Viewer Only applies here. However, unlike Viewer, in this case the control is performed per user, and not per IP or license. To do so, users can use the user configuration on permission **Remote Domain write access**, which is on the **Domain** security item.



User Permissions

With that, it may be necessary that the Remote Domain connection specify a user to have complete access to Domain objects. This user must be specified in the **User in Domain** field, via the **Use this account** option, on **Remote Domains** tab of the Client Domain configuration. There, users must specify both login and password of an existing user in the Domain accessed remotely.

In addition to the **Read-Only access** mode, it is possible to block remote access completely, which demands that the connection with the Remote Domain specifies a given user to grant access to remote objects. This is performed via the **Remote Domain access** permission, also on **Domain** security item.

NOTE: The **Remote Domain access** permission always precedes the **Remote Domain write access** permission. This means that when the first permission is denied, the second one is not used even when explicitly granted. When no access permission is configured, any Domain can connect remotely to another one by using an anonymous user.

3.11.5 Hot-Standby

A remote connection to the Domain has native support to Hot-Standby Domains. To do so, just specify two different server names (main and backup) in their respective items in the **Identifying servers in the network** field, on **Remote Domains** tab. Users should notice that, for Hot-Standby proper work, these names must be the same ones configured by the Remote Domain being accessed. Once this configuration happens at run time, the E3 Server will constantly try to connect to both servers, routing access of all **Application.GetObject** methods and Links to the first accessible server, and that indicates it is running the Domain. In case the server names change when the Client Domain is running, it will disconnect and restart a connection with these new servers.

3.11.6 Connection Management

Even when there is no Hot-Standby configuration, there is a control over the Remote Domain connection between Client and Server E3 Servers. This connection uses the REC protocol, the same one used between E3 Server, E3 Viewer, and E3 Studio. Therefore, a REC connection port and its possible firewall configurations also apply to Remote Domains.

Once connection is established, there should be a running Domain. In this process, a connection is reestablished whenever a problem occurs. After finding a running Domain, its correct name is checked, as well as the user login (if necessary).

Similar to what happens with E3 Studio's and E3 Viewer's REC connections, communication statistics of Remote Domain connections can be viewed on E3 Server's Statistics window, available via E3 Admin icon on Windows Notification Area.

3.11.7 Disconnection

A Client Domain may not be able to establish a connection to a Server Domain for several reasons, which might be:

- Client or Server machine is not connected to a network
- Server is not running an E3 Server
- Server's E3 Server does not have the correct Domain, or Domain has not been started yet
- Server Domain does not accept the user specified by the Client Domain

- Client's or Server's E3 Server does not have a Remote Domain license
- Server's E3 Server version is an older one (2.5 or previous)
- There is a firewall blocking the port used by REC, or Client and Server ports do not match
- Domain alias does not exist in the Remote Domain configuration

When at least one of the previous situations occur, all client links referencing a Domain are disconnected, as well as all **Application.GetObject** methods referencing a Remote Domain fail, that is, cause script errors. As soon as this problem is solved, Links should connect automatically. **Application.GetObject** methods, however, must be executed again.

3.12 Generating Logs in E3

E3 generates logs in ETL (*Event Trace Log*) format. These log files are managed by an Elipse tool called **Elipse Event Log Viewer**, available with E3 installation. With this tool, users can view these files and manage the space they occupy on disk, among other tasks. For more information about **Elipse Event Log Viewer**, please check **Elipse Event Log Viewer User's Manual**, available via **Start - Programs - Elipse Software - Elipse Event Log** menu. **Elipse Event Log Viewer** can be opened using three different ways:

- Via **Start - Programs - Elipse Software - Elipse Event Log - Log Viewer** menu
- Via E3 Studio's **Tools - Log Viewer** menu
- Via **Shortcuts - Log Viewer** option of E3 Admin's contextual menu on Windows Notification Area

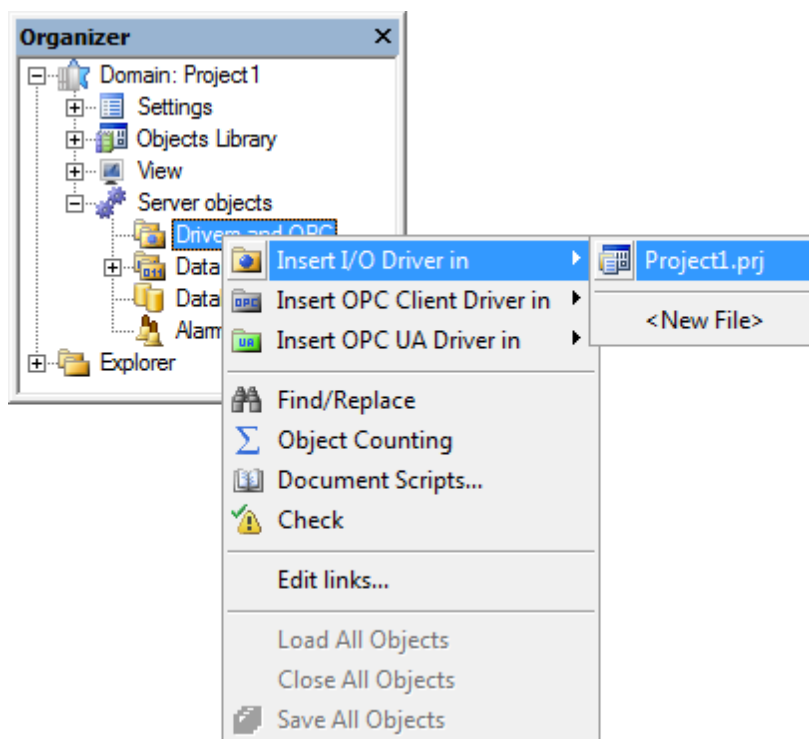
E3 allows communication with data acquisition devices, controllers, PLCs (*Programmable Logic Controllers*), RTUs (*Remote Terminal Units*), or any other type of device, by using its own I/O Drivers or OPC Servers, according to the type of device or communication needed.

NOTE: Driver objects (I/O Driver, I/O Folder, I/O Tag, I/O Block, I/O Block Element, OPC Driver, OPC Tag Group, OPC Folder, OPC Tag, OPC Block, and OPC Block Element) can be configured to work as **Alarm Areas**.

4.1 I/O Driver

An **I/O Driver** is an E3 module that communicates with a certain device by using .dll files. These Drivers are developed either by Elipse Software or by third-parties using a DDK (*Driver Development Kit*), supplied by Elipse Software, using the C/C++ programming language. Each Driver implements a different family of devices or protocols, according to the type of device or communication protocol. New Drivers are constantly developed by Elipse Software.

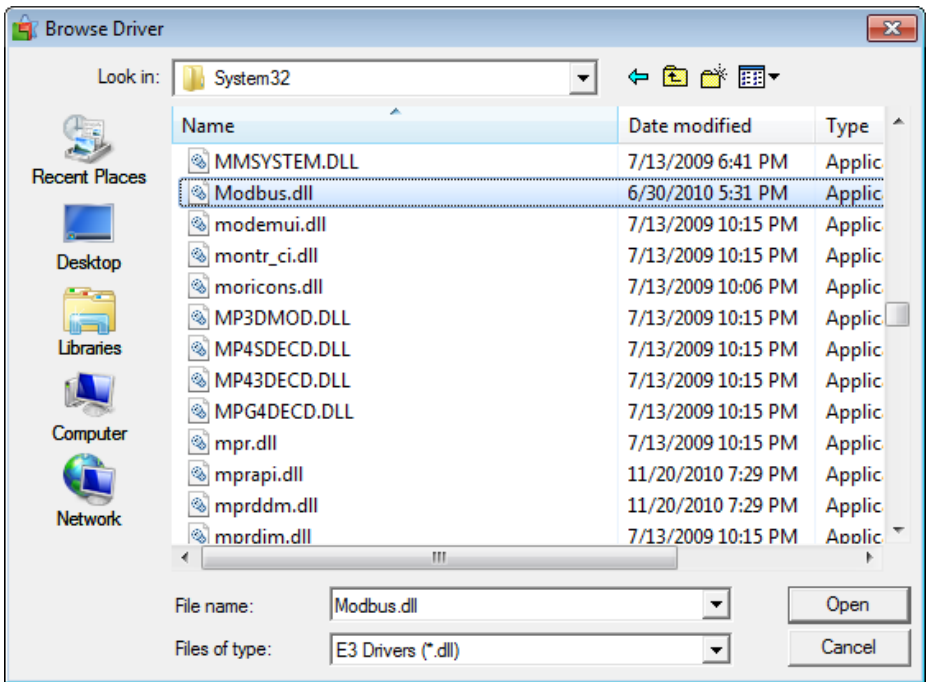
To insert an I/O Driver in a project, right-click project's name in Explorer and select the **Insert - I/O Driver in** option. In **Domain** mode, right-click the **Server objects - Drivers and OPC** item, select the **Insert I/O Driver in** option, and then a project's name.



Inserting an I/O Driver in Domain mode

4.1.1 Configuration

To determine an I/O Driver to use, click the **DriverLocation** property or right-click a Driver and select the **Browse DLL** option. A dialog box for selecting a .dll file that contains a Driver is displayed, according to the next figure.



Selecting a Driver

For more information on individual settings for each Driver, please refer to their respective help files, where information on [P] parameter's configuration is available, as well as other properties available on Driver settings window.

4.1.1.1 Communication Test

When configuring an I/O Driver, users can perform a test procedure to check whether its values are correct and being updated with no problems. When clicking an I/O Driver, the **Activate Driver** option is then opened.

Thus, the specified I/O Driver is loaded and its variable values can be viewed in each Tag's **Value** field on its design view. In case there is a Tag with its **AllowRead** property set to False, or even with no value to be reported, this row appears in gray.

When a Tag has communication errors, its row turns into red, and in case it has no problems, its row turns into blue. To interrupt this monitoring process, right-click an I/O Driver again and select the **Deactivate Driver** option.

4.1.2 How I/O Drivers Work

An **IOServer** is an E3 module responsible for communicating with a device. It is inside an IOServer process that Driver's DLL is loaded and communication with that device is then performed.

I/O Tags enable users to read or write a set of values, by using an I/O Driver where they are inserted. Users can also use I/O Blocks to read more than one variable simultaneously. To access each I/O Block value, use a Block Element, which can be inserted in that object. These objects are discussed in the next topics.

By default, E3 creates an IO Server for each I/O Driver at run time. Based on each Tag's scan time (its **Scan** property), a Driver periodically requests each Tag value. Every time a Tag value or Tag quality is modified, its value is then reported to an I/O Driver.

Each variable's cycle time check is made sequentially. In case some variable's cycle time expires, an IO Server then keeps asking for its value, moving on to the next variable until the whole spreadsheet is complete, and then it returns to the beginning for a new scan.

Users can reserve a smaller cycle time for variables that need to be updated more quickly, and a larger cycle time for variables whose updating priorities are low. It is important to notice, however, that communication performance depends on a lot of factors, among which are device type, communication interface type in use, baud rate, error rate, etc.

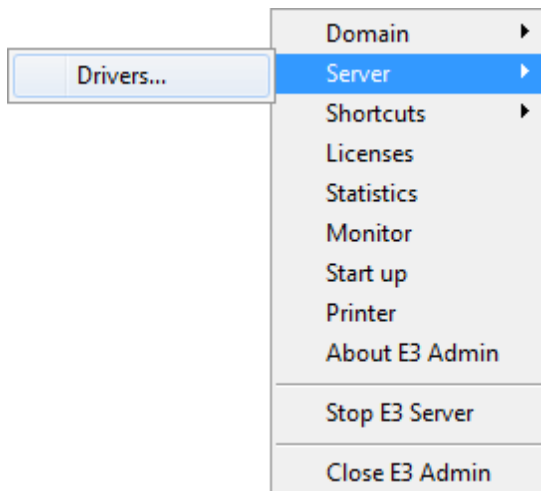
Whenever E3 sends a request to set values to one or more variables, this request has a higher execution priority, relative to a Tag scan.

In case of an IO Server failure, E3 automatically restarts this module, to get back to work. On the other hand, an IO Server stops working in case there is no E3 Runtime (**Main** or **Standby**) to receive its data.

When using the **ShareServer** property, users can share the same IO Server among several I/O Drivers. The first Driver executing is responsible for starting communication procedures, such as opening a serial port or initializing a communication interface. The next shared I/O Drivers then use the same IO Server opened by the first one, which allows sharing communication interfaces used by a Driver.

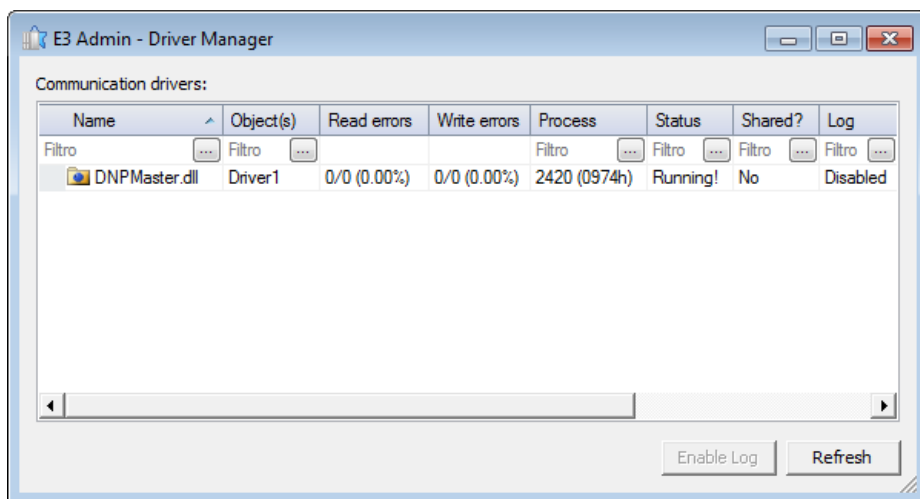
This may be an advantage, because many communication devices such as modems, serial ports, and other interfaces, allow just one connection, preventing simultaneous usage by more than one Driver. When sharing Drivers, users can reuse the same connection for more than one object. Users should notice that settings for shared Drivers must be the same, for a proper working of Driver sharing.

When a Domain is executing, users have access to I/O Driver's execution interface, named **Driver Manager**.



Access to Driver Manager

Driver Manager allows users to view all Drivers in execution, displaying their properties. On this window users can sort Drivers by any column, by clicking a desired column's name. It is also possible to filter values on columns (except for **Read errors** and **Write errors** columns) by clicking and then typing a filter for the desired column.



Driver Manager

The available options on this window are described on the next table.

Available options for Driver Manager window

OPTION	DESCRIPTION
Name	Informs Driver's name.

OPTION	DESCRIPTION
Object(s)	Informs an I/O Driver's name linked to a Driver.
Read errors	Displays the total amount of this Driver's readings, the amount of reading errors, and a percentage of errors relative to the total amount of readings.
Write errors	Displays the total amount of this Driver writings, the amount of writing errors, and a percentage of errors relative to the total amount of writings.
Process	Displays a process ID for this IO Server in the operating system.
Status	Displays the current Driver status (configured, starting, running, finishing, finished, or in error). If a Driver is in error, this column displays an error description.
Shared	Displays YES or NO , informing whether a Driver is shared or not.
Log	Displays a log status (enabled or disabled).
Path	Informs Driver's path in the operating system.
Enable log	Enables Driver's log at run time, without reconfiguring this application. Users can interrupt this recording procedure by using the same option.
Refresh	Forces an update on displayed data.

4.1.2.1 Using a Timestamp

Some devices and protocols allow users to send time information along with variable values. I/O Drivers for such devices can also return clock information stored in each Tag's **TimeStamp** property, with a resolution of 1 ms.

When a device does not support this type of information, or when a Driver is not prepared to handle it, this I/O Driver inserts the current date and time into this timestamp, using computer's clock. With this timestamp, E3 then uses this information both for checking and storing alarms, and also for generating historic files.

In case of Block Elements, the same timestamp is informed for all Block Elements, since they all have been checked at the same time. If a Driver supports both Block and Tag variable readings, in case of Elements representing distinct events, users should use I/O Tags.

For more information on which devices have this feature, please contact Driver's manufacturer. For more information on which Drivers or variable types inside devices use timestamps, please check Driver's help or call Eclipse Software's

technical support.

4.1.2.2 Tags Reported by Events

Tags reported by events can return more than one value at every reading, or return no value at all.

Tags reported by events aim to read data on demand, usually stored on Driver until read by a reading operation. They are generally used for reading events, mass memory data, and unsolicited messages received from a device.

Driver's documentation must specify which Tags available to an application are reported by events.

The most common usage is to collect SOE (*Sequence of Events*). For example, on devices that store really fast variation sequences of digital Tags in memory, or that store telemetry data in memory tables, this data can remain stored in those memory tables, such as in the following figures.

Time	A

Table with three events and a single data field

Time	A	B	C	D	E	F

Table with three events and six data fields

For the first example, one I/O Tag is needed to read value **A**. The **Time** field is returned in Tag's **TimeStamp** property. For the second example, on the other hand, one I/O Block Tag with six elements (from **A** to **F**) is needed, with the **Time** field once again returned in Block's **TimeStamp** property.

In common Tags, not reported by events, a scan time can be configured, which determines a period to read that Tag. At every reading operation, that Tag returns a value (I/O Tag), a block of values (I/O Block Tag), or returns an error. To read all tables previously described, in this case, three reading operations are needed in every table to read three events (that is, three table rows).

Tags reported by events can also allow configuring a scan time. For these Tags, however, every reading operation can return a series of values or blocks of values,

with their own quality and timestamp. That is, when using Tags reported by events to read those previous tables, it is possible to get those three events (data from three rows of every table) at once, on a single reading operation (a single scan).

Reading values returned by Tags reported by events is performed through Tag's **OnRead** event. At every reading operation that return values, an application triggers a series of **OnRead** events. For every returned value or event, an application fills Tag's properties (value, timestamp, and quality) with values from a specific event, and then triggers an **OnRead** event.

In case a Driver does not have events or values to return, that reading operation reported by events, unlike common Tags, may not return any data nor generate any error, as if this operation had never occurred.

A scan time of Tags reported by events can be usually configured with a low value, because CPU consumption, in case there is no value to return, is usually irrelevant.

The **TimeStamp** property of these Tags usually contains a device-provided value.

NOTE: Tags reported by events must be configured with their **EnableDeadBand** property disabled. This avoids that events with very close values to be discarded by an application.

4.1.2.2.1 Recording Events to a Historic

The most common usage for Tags reported by events is to store returned events to a Historic object. To do so, follow these steps:

1. Create a Historic object, with its scan time disabled (its **ScanTime** property set to zero) and no dead band (its **DeadBand** property set to zero).
2. Link **TimeStamp** properties and values of a Tag to this Historic. Other properties can be linked too, in case it is important to store them.
3. Use Historic's **WriteRecord** method on Tag's **OnRead** event.

This procedure ensures that every received value reported by event is stored sequentially on a linked Historic.

4.1.2.3 Pool of IOServer Processes

In applications with hundreds of Drivers, all resources needed to run IOServer processes for each Driver may consume operating system's capacity. In these cases, it may be necessary to enable a **Pool of IOServer Processes** on **Properties** tab of a Domain configuration.

When this Pool is enabled, each IOServer process can execute more than one Driver, then saving operating system's resources and thus allowing an application to run thousands of Drivers.

Only Drivers supporting the creation of new dynamic instances (Drivers compiled with **IOKit version 2.0.6** or later) can be used in this Pool. If a Driver without support is added to this Pool, it is not executed (it fails). For these cases, configure IODriver's **DisableIOServerPool** property to False, so that it runs outside this Pool, in an exclusive IOServer process.

On the **Properties** tab of a Domain configuration, users can control the maximum number of IOServer processes in this Pool, as well as the maximum number of Drivers that run on each IOServer.

Behavior options for a Pool of IOServer Processes

DRIVERS PER PROCESS	MAXIMUM NUMBER OF PROCESSES	POOL'S BEHAVIOR
0	M	As application Drivers are activated, an IOServer process is created for each Driver, up to the maximum number <i>M</i> . After that, every new Driver activated is then added to Pool's IODriver that contains less Drivers.
N	0	As application Drivers are activated, E3 then adds them to a Pool's IOServer process that has not reached the maximum number <i>N</i> of Drivers running in it. If all Pool processes reached their maximum limit, then a new IOServer is added to that Pool.

DRIVERS PER PROCESS	MAXIMUM NUMBER OF PROCESSES	POOL'S BEHAVIOR
N	M	As application Drivers are activated, E3 then adds them to a Pool's IOSever process that has not yet reached the maximum number <i>N</i> of Drivers running in it. If all Pool processes reached their maximum limit, this behavior then depends on the amount of processes in that Pool, and if the number of Pool processes is less than the maximum <i>M</i> , then a new process is added to that Pool. Otherwise, a Driver is added to the process with less Drivers running. NOTE: In this mode, the maximum number of Drivers per process (<i>N</i>) can be surpassed in case the total amount of application Drivers exceeds $N * M$.

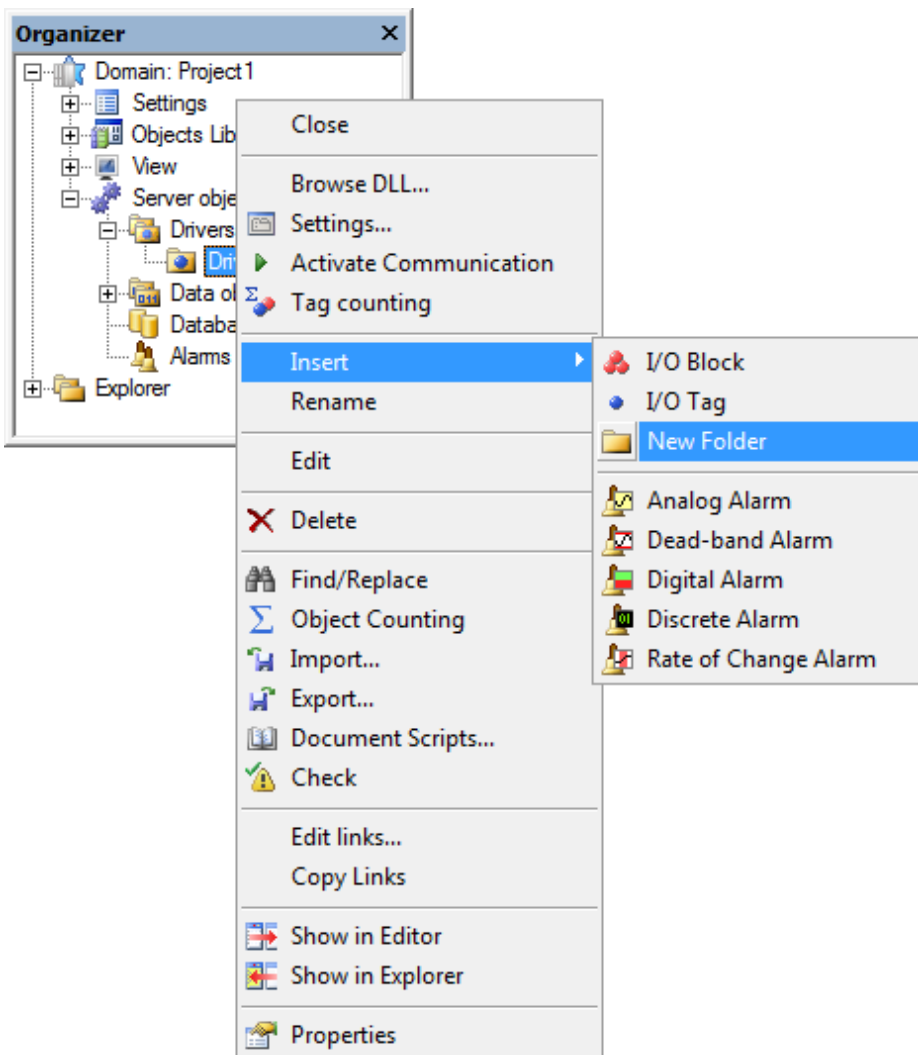
NOTES:

- When grouping Drivers in the same IOSever process, the isolation among these Drivers is lost. This way, if one of these Drivers fail, that IOSever is then closed and all Drivers running in that IOSever must be restarted.
- There is a limit on the number of Drivers that can run in an IOSever process. This limit depends on several variables, such as operating system in use, amount of memory, threads, and resources that each specific Driver is using. Usually, users are not supposed to add more than 100 Drivers in a single IOSever, because that may exceed operating system's limits.

4.1.3 I/O Folder

I/O Folders define groups and subfolders to organize variables. Each Folder can be renamed as needed, and new Folders can be inserted inside one another. To use this resource, follow this procedure:

1. In Organizer, right-click a Driver and select the **Insert - New Folder** option.



Inserting a new I/O Folder

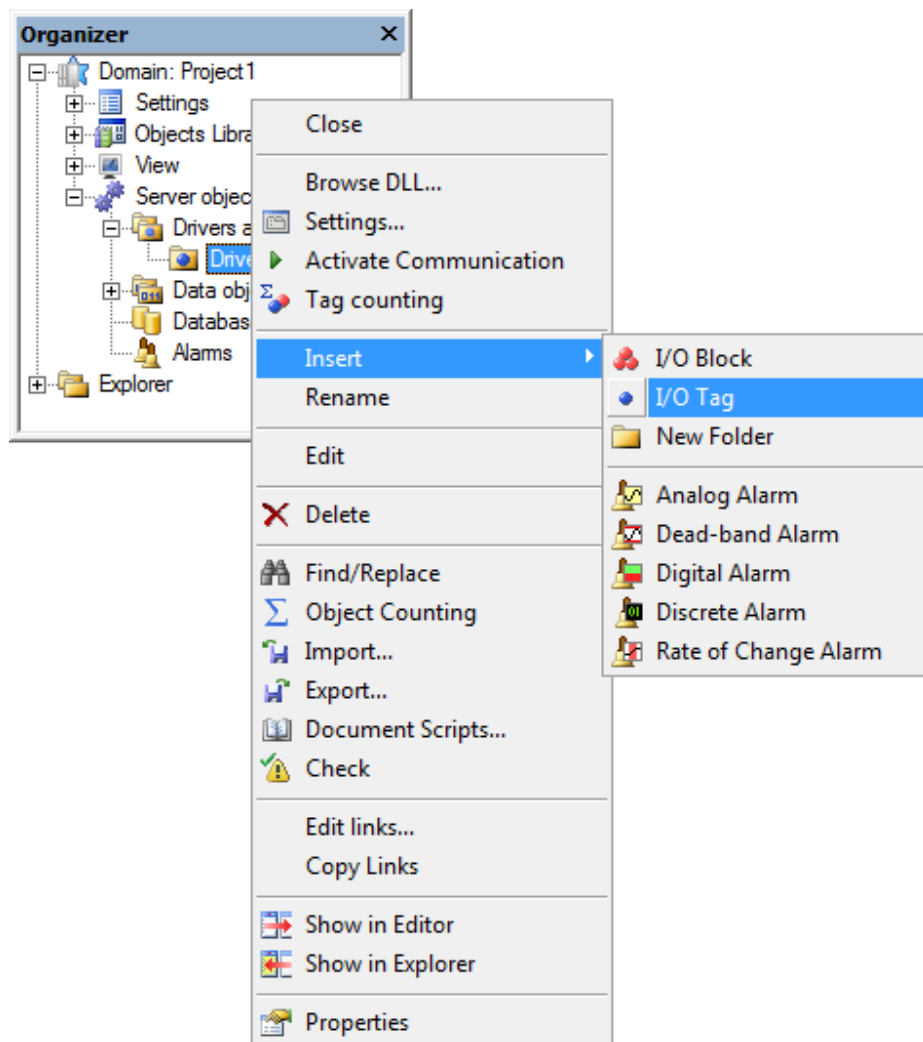
4.1.4 I/O Tag

I/O Tags enable reading or writing a set of values using an I/O Driver. They are used to define information exchange with acquisition devices, which consists in one independent variable.

An I/O Tag can be an analog variable, an input, an output, a counter, a digital point, etc. Several digital points can be grouped in a Tag and accessed by their properties, such as data bits. I/O Tags are configured by a series of N parameters (from $N1$ to $N4$), which vary according to an I/O Driver to use. To use this resource, follow these

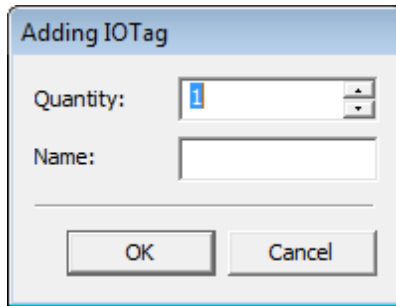
procedures:

1. Insert an I/O Tag in a project, by right-clicking a Driver and selecting the **Insert - I/O Tag** option.



Inserting an I/O Tag

2. Studio then opens up a window asking for a number of Tags to create in this Driver, as well as their names. This name is auto-incremented and if this option remains blank, Tags are created with a default name.



Adding I/O Tags

In case a device in use to collect data informs Tag values that need to be converted, users can use Tag scales, which are basically a specification of a linear conversion between two different bases.

To do so, users must enable Tag's **EnableScaling** property and inform *DeviceLow* and *DeviceHigh* parameters (via their respective properties), which are respectively low and high limits of device's data, and also inform *EULow* and *EUHigh* parameters (via their respective properties), which are low and high data limits, in engineering units.

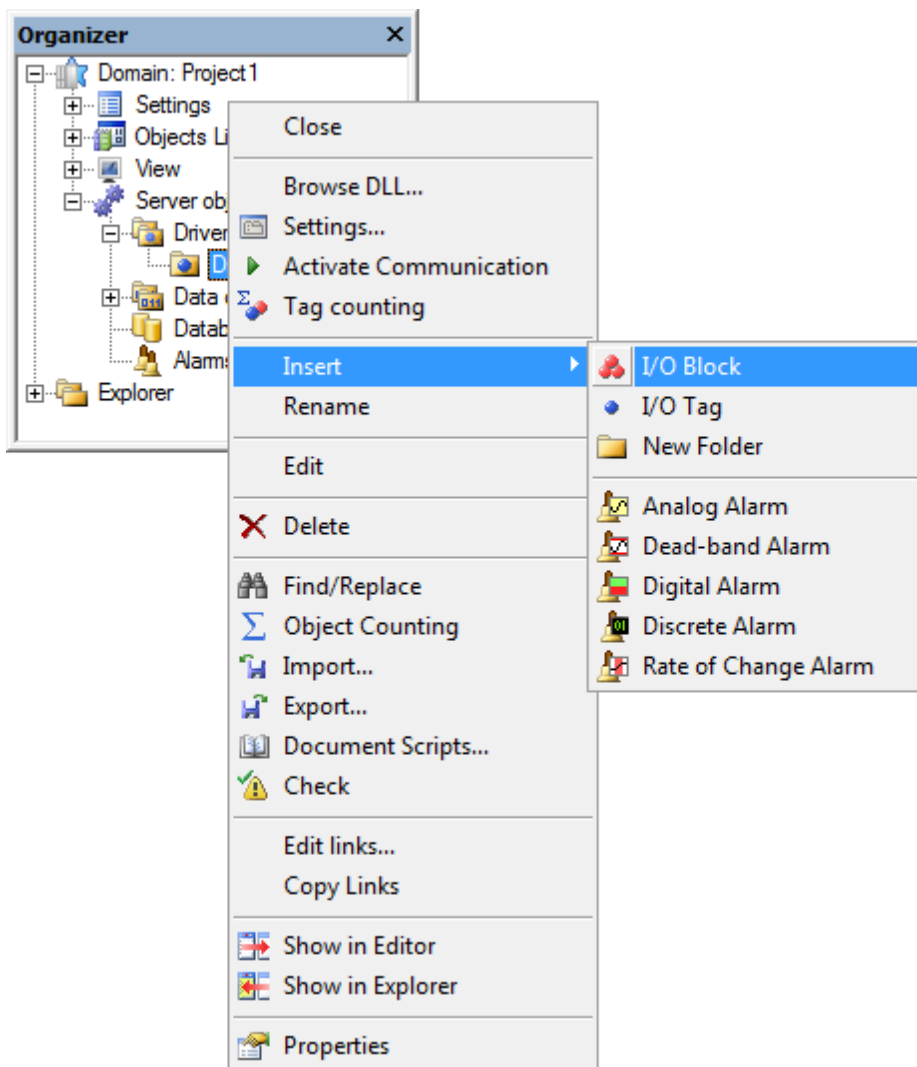
Some of this object properties can be configured directly on Properties List, without creating scripts for this. More information on this object's properties functionality can be found on **Scripts Reference Manual**, in their respective chapter.

4.1.5 I/O Block

I/O Blocks are used to define information exchange with an acquisition device, which consist of one or more variables, as long as they are consecutive in an addressing inside an external device.

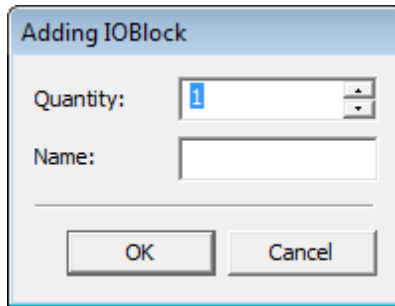
Depending on the communication method used, users can save time in communication, thus obtaining a larger number of updates at the same time interval, when compared to an I/O Tag. I/O Blocks are configured using a series of *B* parameters (from *B1* to *B4*), which vary according to an I/O Driver used, along with the **Size** property, which defines the number of Elements or indexes available in a Block. To use this resource, follow these procedures:

1. Right-click a Driver and select the **Insert - I/O Block** option.



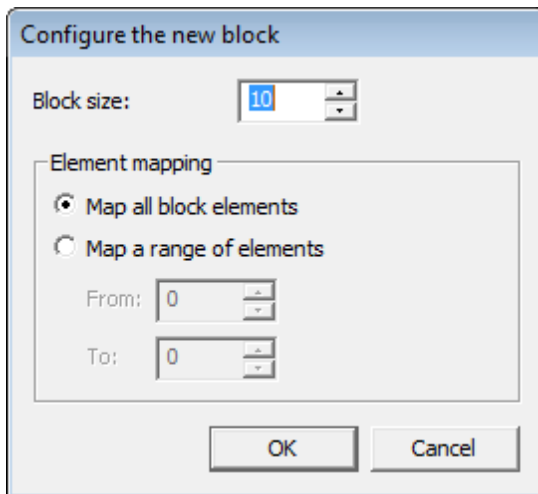
Inserting an I/O Block

2. Studio then opens up a window asking for a number of Blocks to create in this Driver, as well as their names. This name is auto-incremented and if this option remains blank, Blocks are created with a default name.



Adding I/O Blocks

3. Studio then shows a window to determine the number of Block Elements in this object. In this option, users can indicate a mapping for all Elements in a Block, or in a given Element's interval.



Configuring a new I/O Block

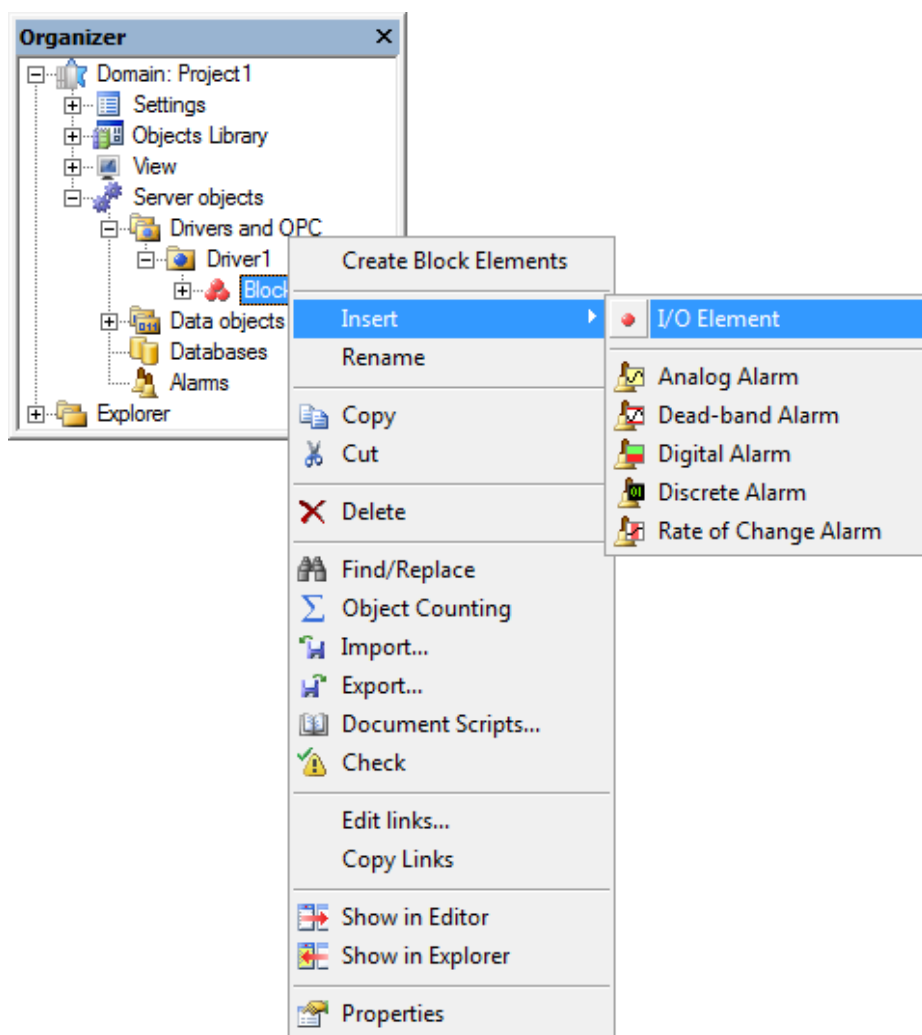
4. Inform a Block size and its mapping options.
5. Click **OK**.
6. If necessary, configure object's properties.

Some properties in I/O Blocks can be configured using Properties List, and there is no need to create scripts for this. To configure any property, locate it on Properties List and perform the necessary adjustments. For more information on properties, please check the **Scripts Reference Manual**.

4.1.6 Block Element

Block Elements represent links for every position in a Block to use as if they were I/O Tags. Block Elements can freely point to each index inside a Block. There can be two Block Elements pointing to the same index in a Block, and also to more, less, or the same number of Elements as the number of variables declared in a Block. To use this resource, follow these procedures:

1. Right-click an I/O Block and select the **Insert - I/O Element** option.



Inserting a Block Element

In case of a device used to collect data informs Tag values that need to be converted, users can use Tag scales, which are basically a specification of a linear

conversion between two different bases.

To do so, users must enable Element's **EnableScaling** property and inform *DeviceLow* and *DeviceHigh* parameters (via their respective properties), which are respectively low and high limits of device's data, and also inform *EULow* and *EUHigh* parameters (via their respective properties), which are low and high data limits, in engineering units.

Some of this object properties can be configured directly on Properties List, without creating scripts for this. More information on this object's properties functionality can be found on **Scripts Reference Manual**, in its respective chapter.

4.2 OPC Server

In addition to an OPC client (**OPC Driver**), E3 also works as an OPC Server DA (*Data Access*) 2.0x. This allows E3 to expose all existing objects in the executing Domain (I/O Tags, for example) to applications external to E3. Some examples are Elipse SCADA, E3 (which can be executing on another application as a client), or an OPC client from another manufacturer, as long as this client implements the **OPC DA 2.0x** standard or later.

NOTE: E3's OPC Server is an additional module since version 3.0, and it needs a specific license on a protection device. Please contact **Elipse Software** for more information.

4.2.1 Features

To use E3's OPC Server, it is not necessary any extra configurations, just run a Domain so that any OPC client can communicate with E3. To connect to an E3's OPC Server from any client, select the server identified as **Elipse.OPCSvr.1**.

An OPC Server allows any client to easily import all Tag definitions to a Domain (the **Browse** function). Of course, the available Tags are just objects that are part of a server, that is, Screen items (Viewer) are not accessible using an OPC Server.

Because it is based on the same linking technology used by internal links among objects, E3's OPC Server allows clients to use Tags that are mathematical expressions, and with transparent connection or disconnection during execution.

4.2.2 Status Information

By using status information (a default OPC functionality), an OPC client can identify whether an E3 server is currently with no Domain, is in standby, or is running normally. Possible values for OPC status are the following:

- **Domain running normally:** OPC_STATUS_RUNNING
- **Domain in standby mode:** OPC_STATUS_SUSPENDED

- **Domain stopped, or no Domain:** OPC_STATUS_NOCONFIG

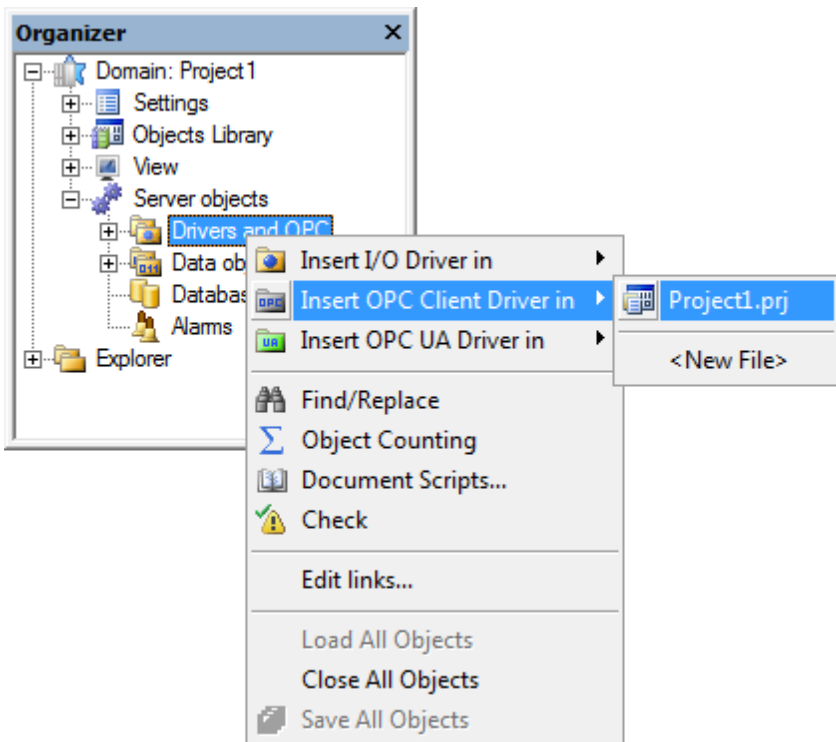
4.2.3 Disconnection

For OPC clients that support a shutdown feature, a warning is always sent whenever a Domain is stopped, or is in standby mode. After that warning, all OPC clients are disconnected.

4.3 OPC Driver

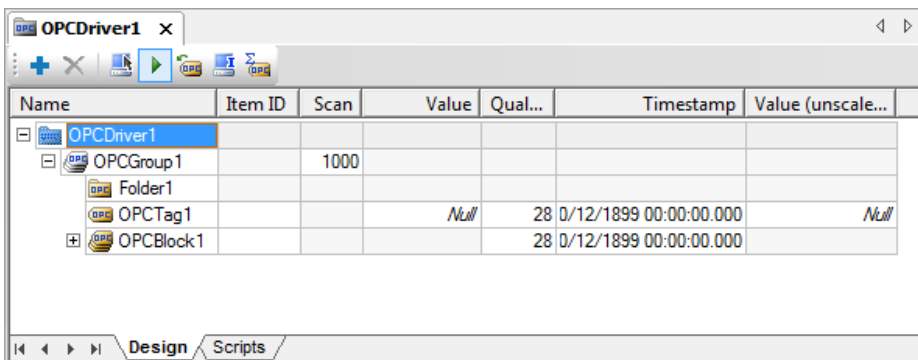
An **OPC Driver** is a module responsible for collecting data from external devices executing an OPC Server, which can be supplied by any manufacturer. Tags can be imported to an OPC Driver inside E3 (in this case, working as an OPC client), or even created in E3. To use an OPC Driver, follow this procedure:

1. Right-click project's name and select the **Insert - OPC Client Driver in** option.



Inserting an OPC Driver

When inserting an OPC Driver in an E3 Studio application, this object's view is opened, as seen on the next figure.



OPC Driver's view

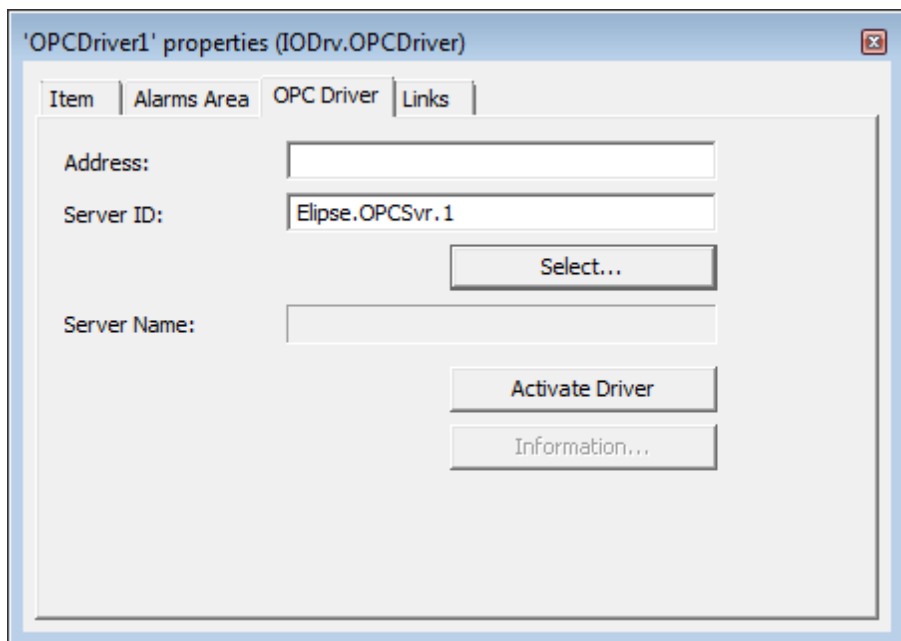
The available options on this view are described on the next table.

Available options for OPC Driver's view

ICON	OPTION	DESCRIPTION
	Add	Adds a new Group to a Driver; a Tag, Block, or Folder to a Group; or an Element to a Block.
	Remove	Removes the selected item from this view.
	Select server	Selects an OPC Server.
	Activate/deactivate communication	Activates or deactivates Driver communication.
	Import tags	Imports Tags to this OPC Driver.
	Information about server	Displays a window with Driver's settings.
	Tag counting	Displays the total amount of Tags in this Driver.

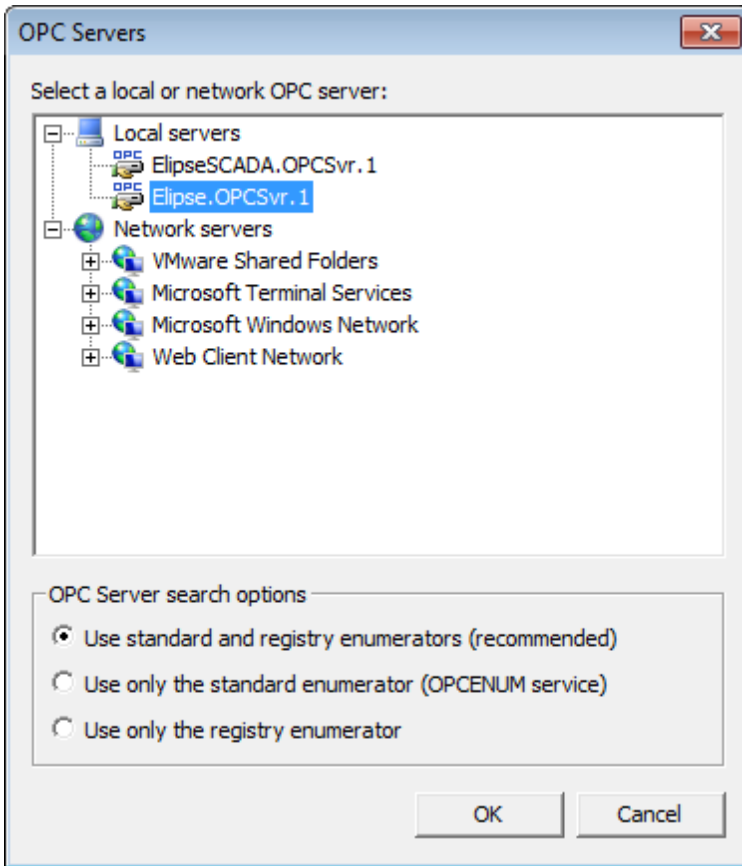
4.3.1 Configuration

An identification for other objects belonging to an OPC Driver can be inserted manually, or else automatically retrieved from an OPC Server. To do so, open Driver properties window, by right-clicking it and then selecting the **OPC Driver** tab.



OPC Driver tab

Type an **Address** and a **Server ID** and then click **Select**. The following window is then displayed.



Selecting an OPC Server

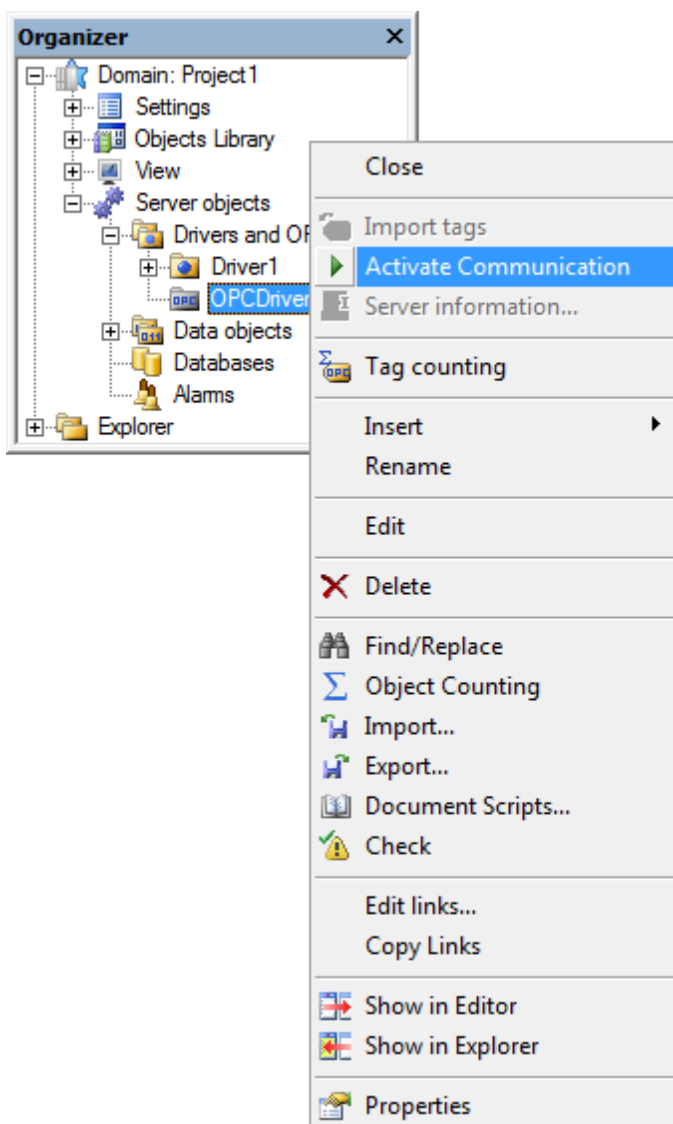
The available options on the **OPC Server search options** item are described on the next table.

Available options for OPC Server search options item

OPTION	DESCRIPTION
Use standard and registry enumerators (recommended)	E3 tries to search for Driver specifications, either via Windows Registry or via standard OPC enumerator (OPCENUM).
Use only the standard enumerator (OPCENUM service)	E3 tries to search for Driver specifications only via standard OPC enumerator (OPCENUM).
Use only the registry enumerator	E3 tries to search for Driver specifications only via Windows Registry.

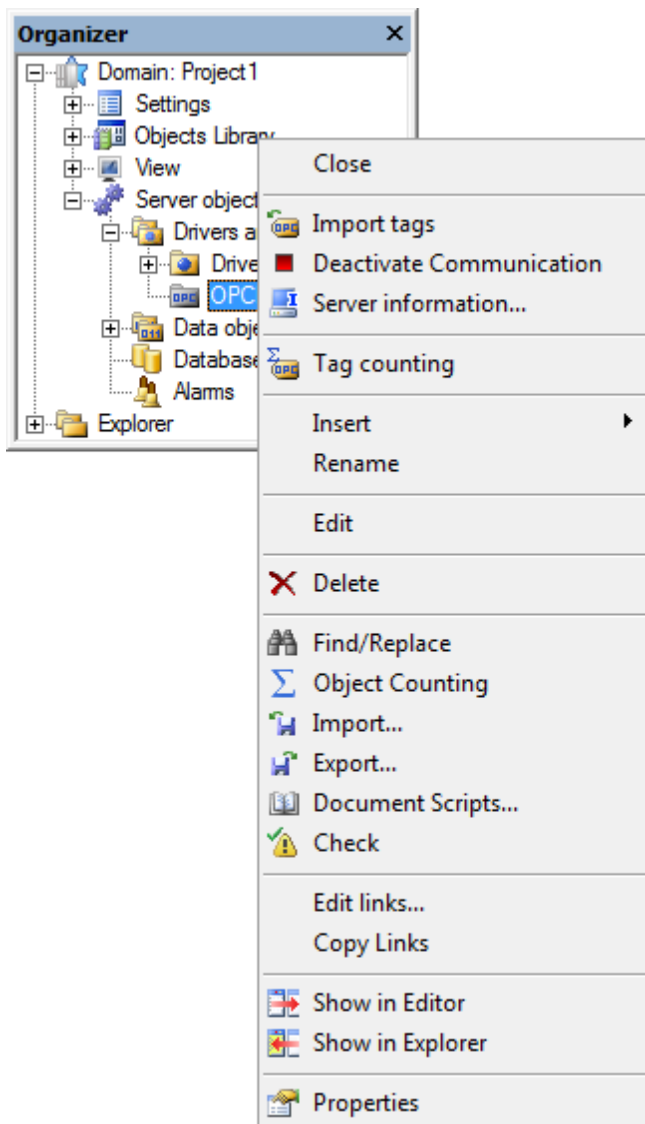
By clicking **OK**, an application displays Driver's data, indicating path and server

name. To activate OPC Driver communication, click **Activate Communication**.



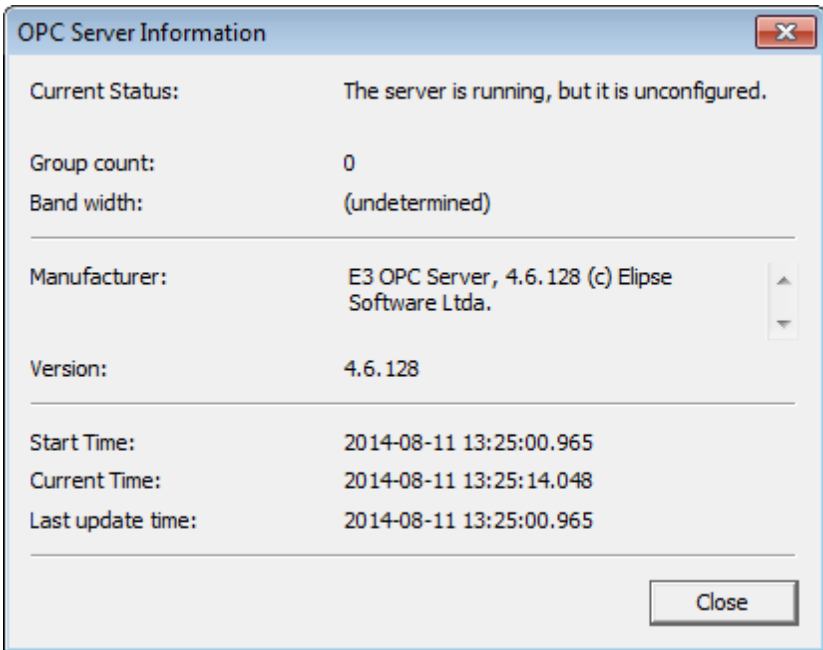
Activating OPC Driver communication

When communication is activated, the **Server Information** and **Import Tags** options are enabled, and also the **Deactivate Communication** option. To use these options, right-click an OPC Driver and select the preferred option.



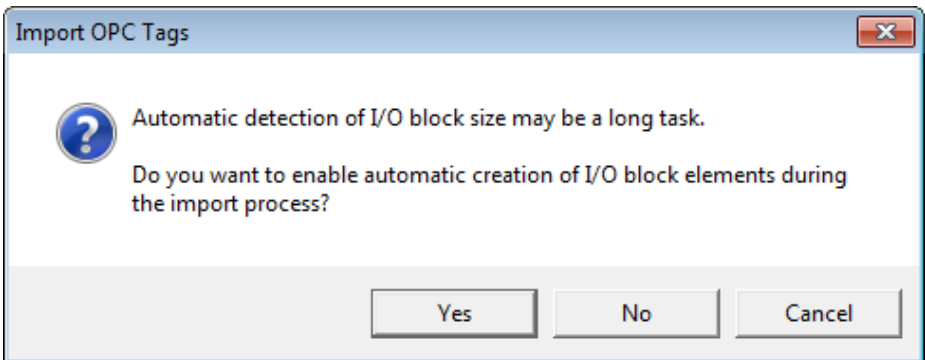
Enabled options when an OPC Driver is active

The **Server Information** option shows a window with Driver configurations.



OPC Server information

By using the **Import tags** option, users can import Tags to an OPC Driver. When this option is selected, the following message is displayed.



Message referring to OPC Tag import

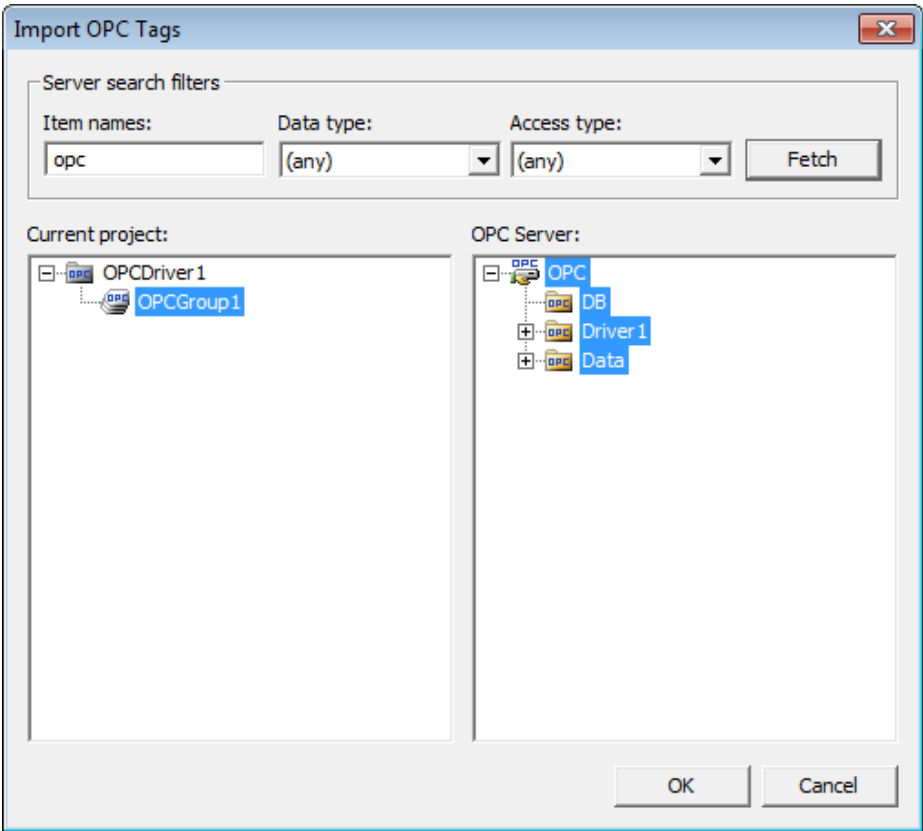
The available options are the following:

- **Yes:** When locating OPC Tags, E3 automatically tries to detect which Tags are Block Tags and, in this case, how many Elements they have. To do so, E3 needs to read each Element's value, and depending on the server and on the number of Tags, this can be a time-consuming task
- **No:** E3 does not try to read OPC Tag values when performing this search. This operation is quicker, but it does not create **Block**-type OPC Tags and their

Elements automatically

- **Cancel:** Cancels this import operation

The Import OPC Tags window provides all resources displayed on the next figure.



Importing OPC Tags

The available options on this window are described on the next table.

Available options for Import OPC Tags window

OPTION	DESCRIPTION
Item names	Filters Tags using the name of these specified items. Users can use wild cards, such as * (asterisk) or ? (question mark).
Data type	Filters Tags using a data type specified in this field, which can be Integer , Long , Single , etc.

OPTION	DESCRIPTION
Access type	Filters Tags using an access type specified in this field, which can be Read only , Write only , and Read and Write .
Show only items with IDs not found in the current project	Filters Tags so that this application only shows items with IDs not found in a project.
Current project	Shows selected objects to add to the current project .
OPC Server	Shows available Tags in a server for import.

To import Tags, select a Tag and drag it to an OPC Driver or OPC Group. To deactivate OPC Driver communication, click **Deactivate Communication**.

Some OPC Driver properties can be configured using Properties List, without creating scripts for this. To configure any property, locate it on Properties List and perform the necessary adjustments. For more information, please check the **Scripts Reference Manual**.

4.3.1.1 Functionality

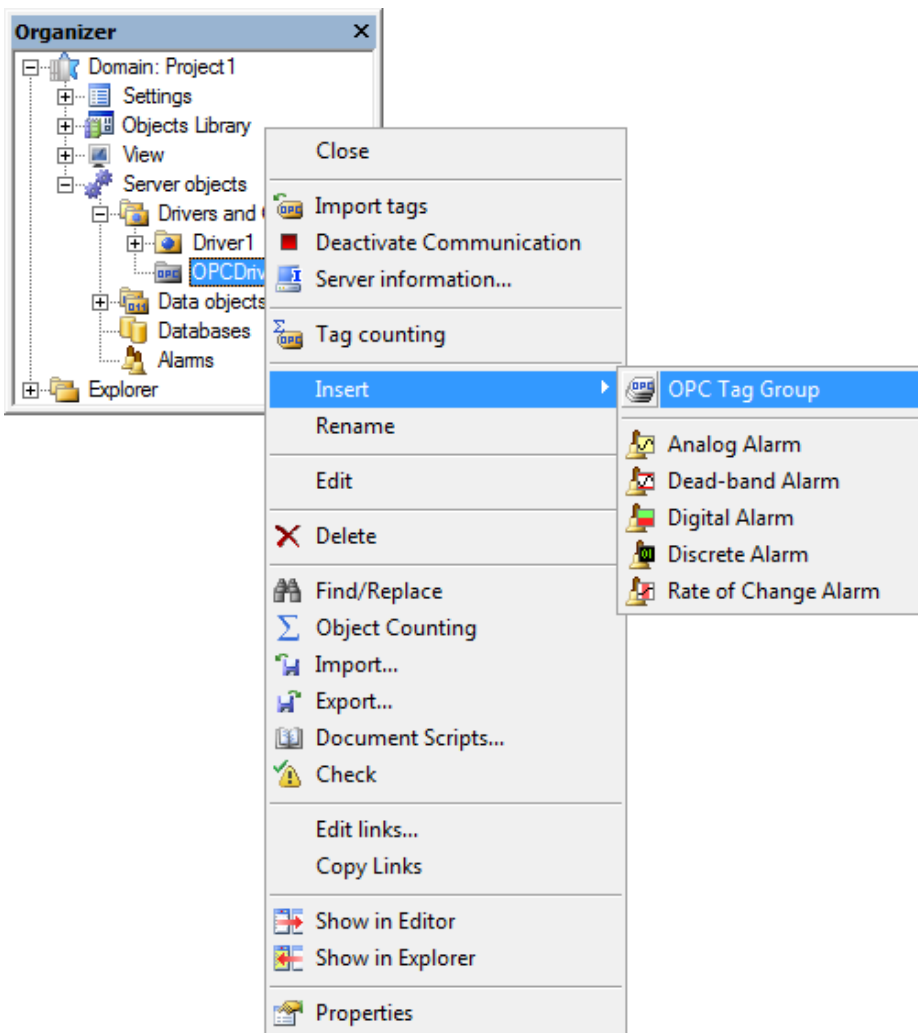
Communication of E3's OPC client with an OPC server is performed by a separate process. This process, when OPC Driver is activated in Studio, executes on the current user logged in Windows. At run time, on the other hand, this process is executed on **SYSTEM** account. Some OPC servers may be sensitive to the account they are running on and, for this reason, it may be necessary to reconfigure this process to execute on a specific user. To do so, follow these procedures:

1. Go to **Start - Control Panel - Administrative Tools - Component Services** menu or type **dcomcnfg** on Windows command prompt.
2. Expand the **DCOM Config** item in **Component Services - Computers - My Computer**, right-click the **E3OpcClient** item and select the **Properties** option.
3. Select the **Identity** tab, select the **This user** item, and fill in the account information.
4. Click **OK** and restart the computer to apply these settings.

4.3.2 OPC Tag Group

An **OPC Tag Group** object gathers a series of OPC Tags that share the same update parameters (scan time and dead band). An OPC Tag Group is mandatory to create OPC Tags. To insert an OPC Tag Group, follow this procedure:

1. Right-click an OPC Driver and select the **Insert - OPC Tag Group** option.



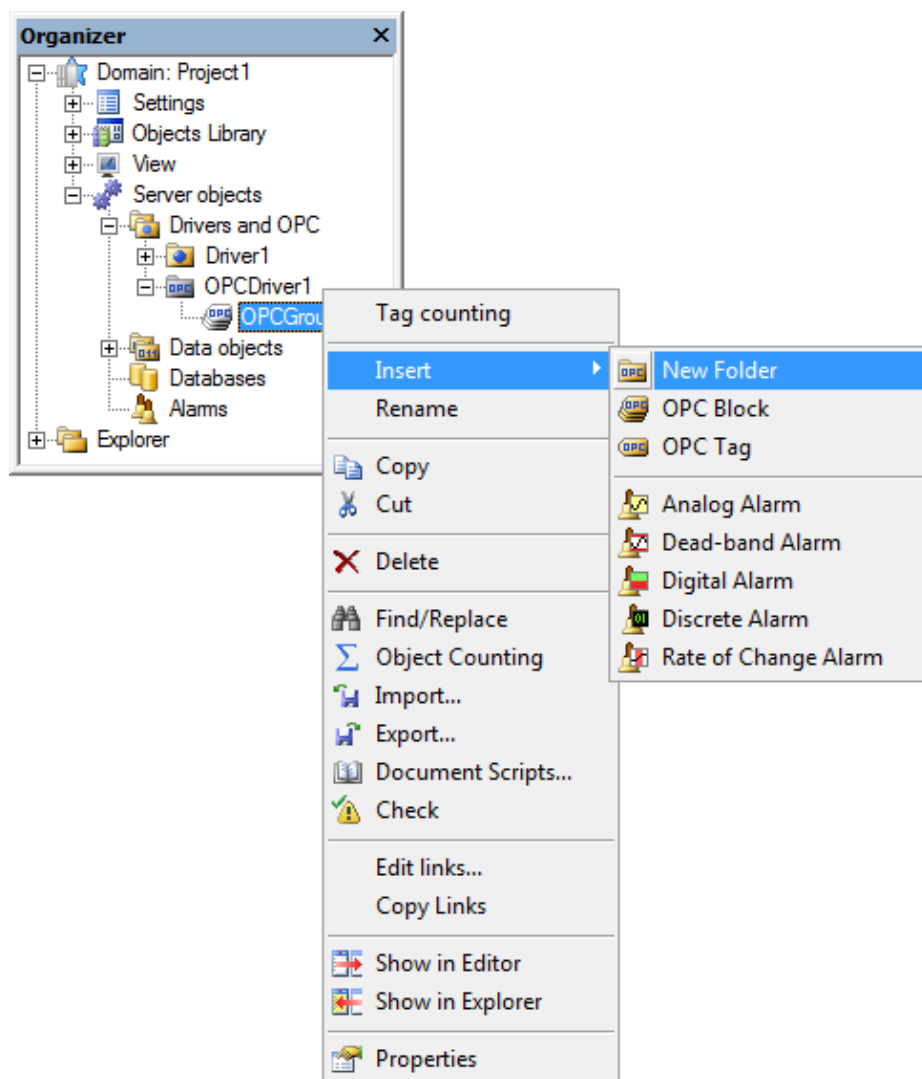
Inserting an OPC Tag Group

Some OPC Tag Group properties can be configured using Properties List, without creating scripts for this. To configure any property, locate it on Properties List and perform the necessary adjustments. For more information on properties, please check the **Scripts Reference Manual**.

4.3.3 OPC Folder

An **OPC Folder** defines groups or subfolders for a better organization of variables. Each OPC Folder can be renamed as needed, and new Folders can be inserted inside one another. If an OPC Folder is disabled at run time, its whole content is deactivated. To use this resource, follow this procedure:

1. Right-click an OPC Group and select the **Insert - New Folder** option.

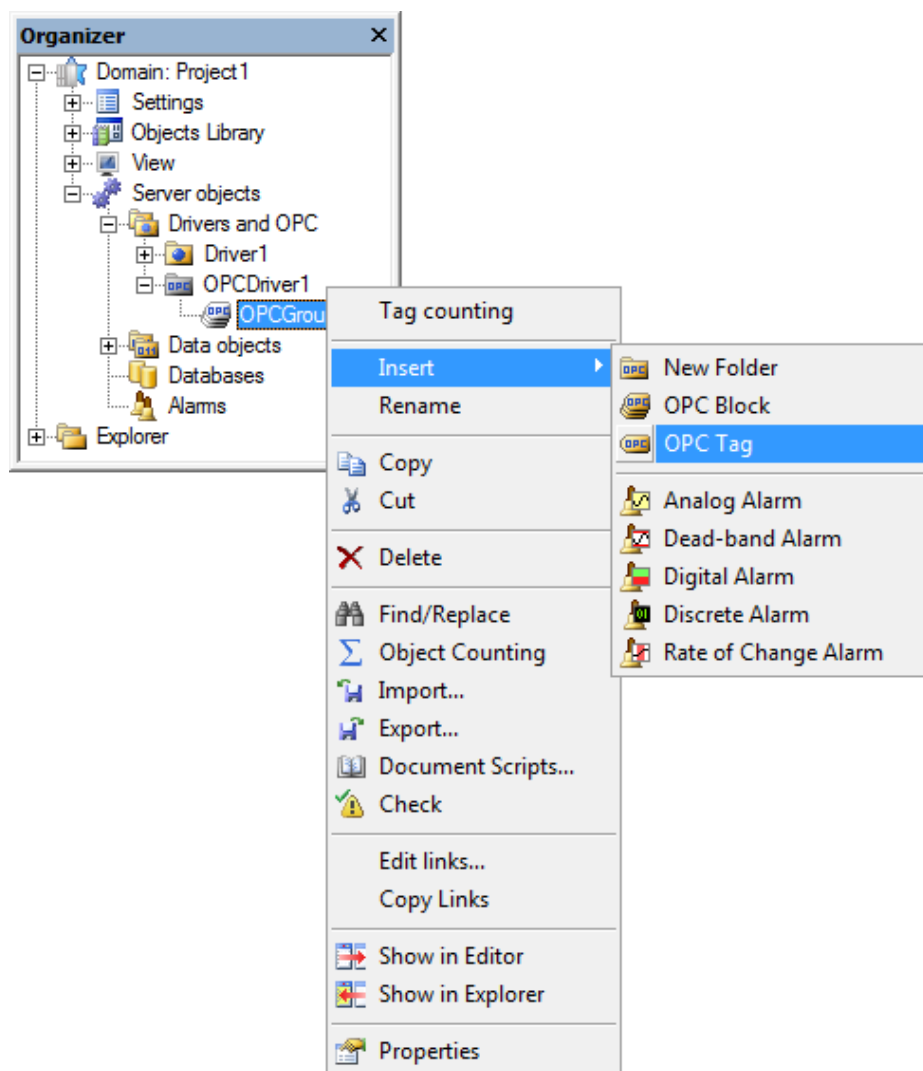


Inserting a new OPC Folder

4.3.4 OPC Tag

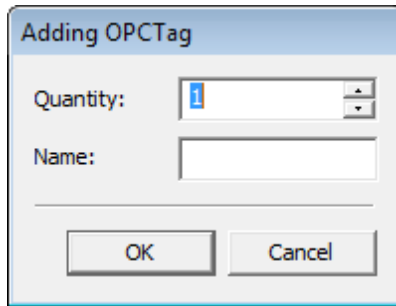
An **OPC Tag** is an object that reads or writes values on a device. A Tag reading is performed automatically by an OPC Server, with a scan time defined by an OPC Group where it is inserted. To use this resource, follow these procedures:

1. Right-click an OPC Group and select the **Insert - OPC Tag** option.



Inserting an OPC Tag

2. Studio then opens up a window asking for a number of Tags to create in this Group, as well as their names. This name is auto-incremented and if this option remains blank, Tags are created with a default name.



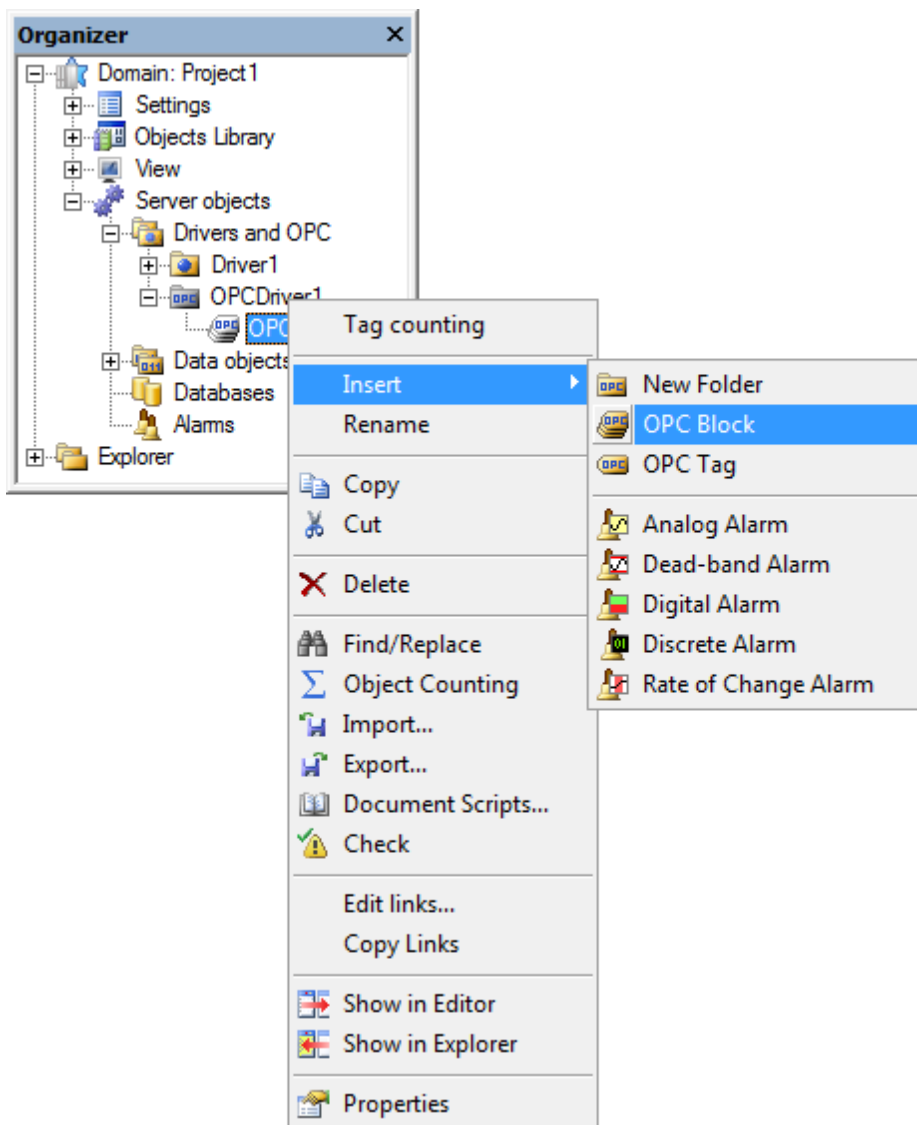
Adding OPC Tags

Some OPC Tag properties can be configured using Properties List, without creating scripts for this. To configure any property, locate it on Properties List and perform the necessary adjustments. For more information on properties, please check the **Scripts Reference Manual**.

4.3.5 OPC Block

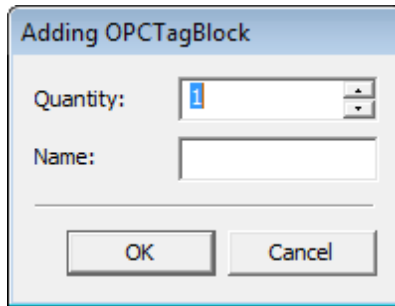
An **OPC Block** allows reading or writing a set of values. For Tag writing, users must set a new value to Tag's **Value** property. Tag reading is performed automatically by an OPC Server, with a scan time defined on its OPC Group. The **Size** property determines the number of Tag Elements on a server. To use this resource, follow this procedure:

1. Right-click an OPC Group and select the **Insert - OPC Block** option.



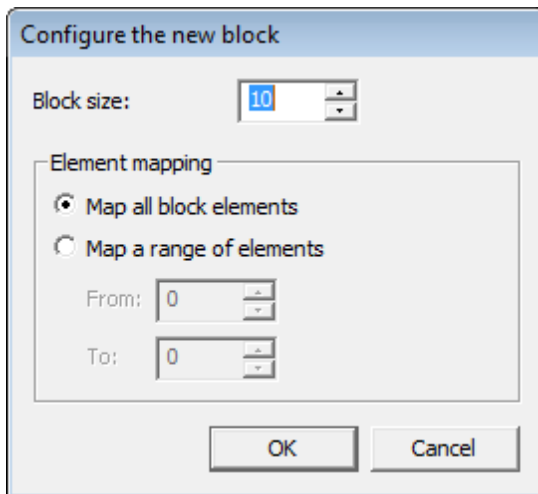
Inserting an OPC Block

2. Studio then opens up a window asking for a number of Blocks to create in this Group, as well as their names. This name is auto-incremented and if this option remains blank, Blocks are created with a default name.



Adding OPC Blocks

3. Studio then shows a window to determine the number of Block Elements in this object. In this option, users can indicate a mapping for all Elements in this Block or inside a given Elements' interval.



Configuring the new Block

4. Inform Block size and Element mapping.
5. Click **OK**.
6. If necessary, configure object properties.

Some OPC Block properties can be configured using Properties List, without creating scripts for this. To configure any property, locate it on Properties List and perform the necessary adjustments. For more information on properties, please check the **Scripts Reference Manual**.

4.3.6 OPC Block Element

An **OPC Block Element** allows reading or writing one of the Elements of an OPC Block where it is inserted.

An OPC Block reads a data table, and this object is always linked to a position defined by its **Index** property. For example, an OPC Block Element with **Index** equal to five, and inserted into an OPC Block with a size of 10, whose data is read as on the following table.

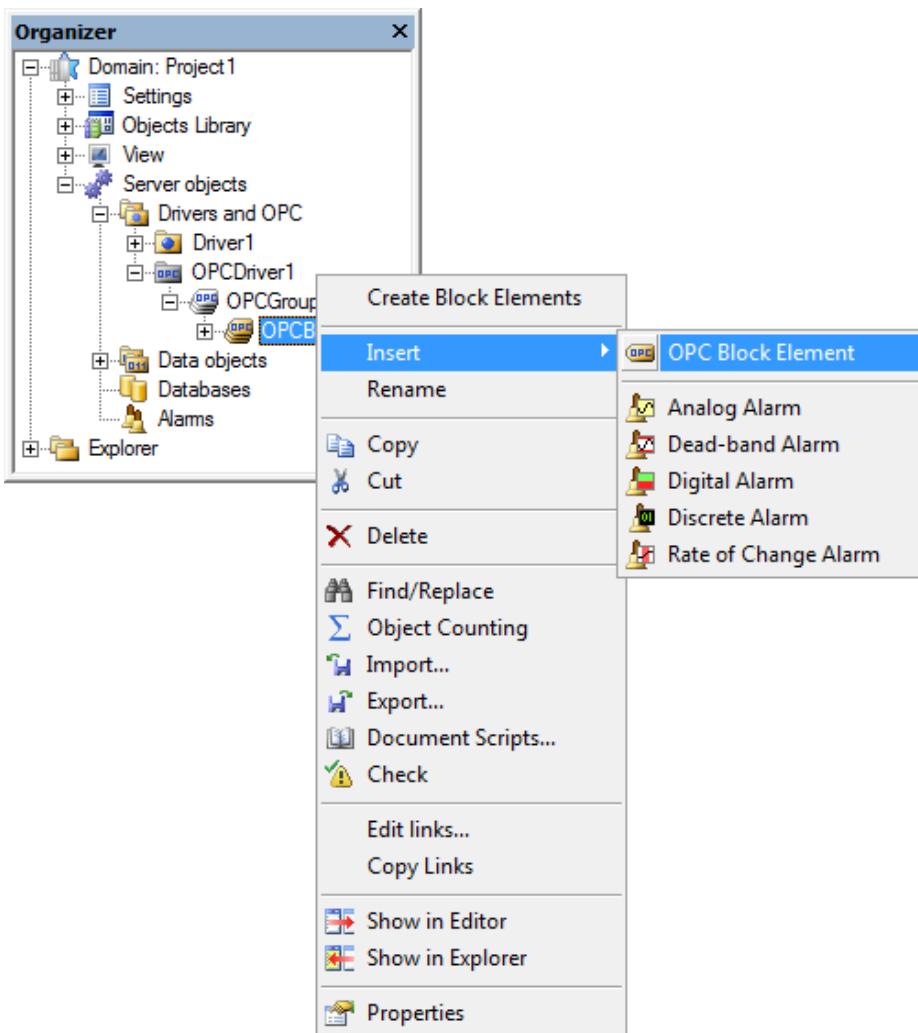
Table	5	12	77	55	1	3	42	20	8	89
Index	0	1	2	3	4	5	6	7	8	9

It would have its **Value** property equal to three, according to the previous table.

NOTE: E3 can create OPC Block Elements automatically. For more details, please check the **Import Tags** item on **Configuration** topic.

To use this resource, follow this procedure:

1. Right-click an OPC Block and select the **Insert - OPC Block Element** option.



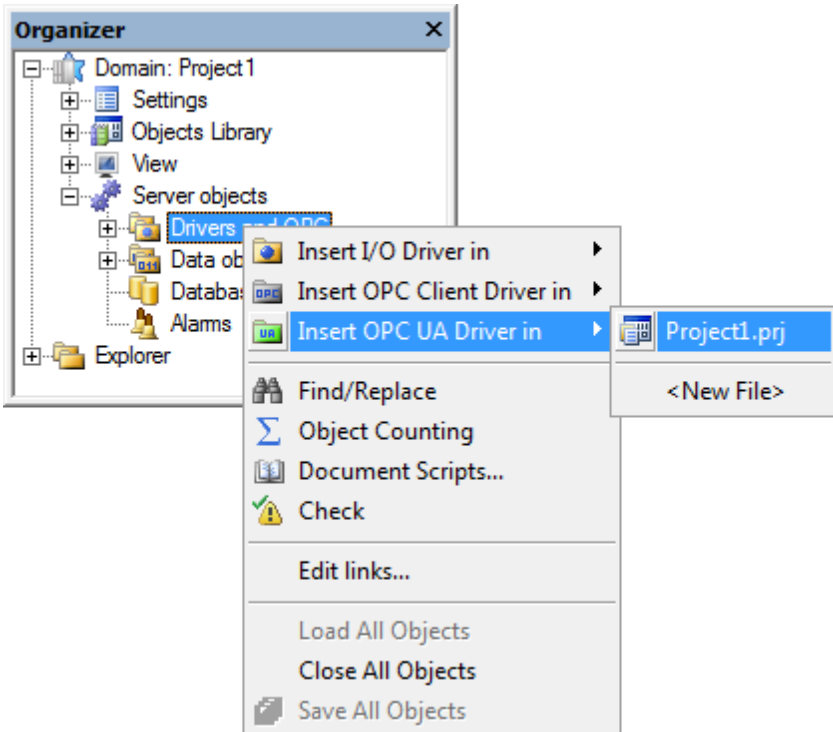
Inserting an OPC Block Element

Some OPC Block Element properties can be configured using Properties List, without creating scripts for this. To configure any property, locate it on Properties List and perform the necessary adjustments. For more information on properties, please check the **Scripts Reference Manual**.

4.4 OPC UA Driver

An **OPC UA Driver** implements a communication with an OPC UA server that implements historical readings, such as **EPM**. This object can be used as a data source for a **Query** object. To insert an OPC UA Driver in a project, right-click this project's name in Explorer and select the **Insert - I/O Driver OPC UA** option. In

Domain mode, right-click the **Server objects - Drivers and OPC** item, select the **Insert I/O Driver OPC UA in** option and then a project's name.

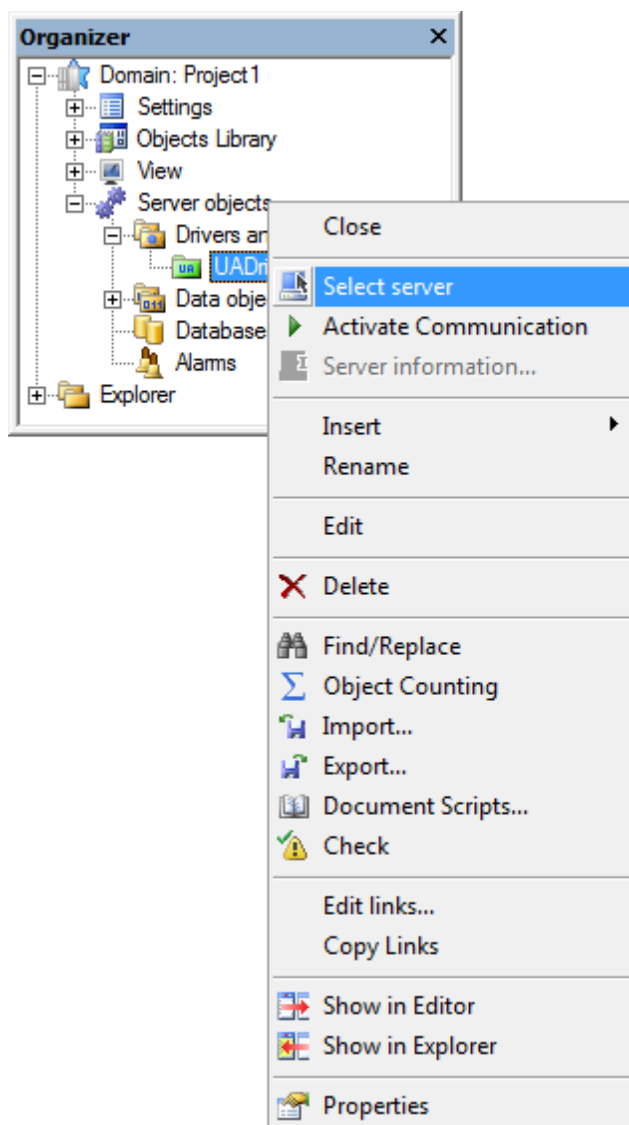


Inserting an OPC UA Driver in Domain mode

Some properties of an OPC UA Driver can be configured using Properties List, without creating scripts for this. To configure a property, locate it on Properties List and perform the required adjustments. For more information, please check the **Scripts Reference Manual**.

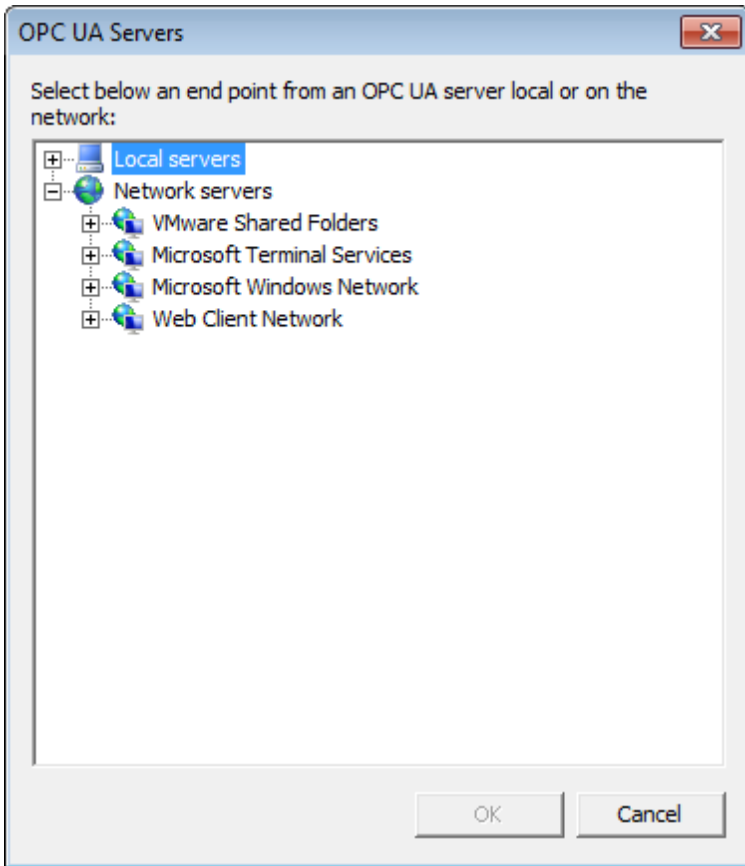
4.4.1 Configuration

Configuring an OPC UA Driver is similar to configuring an **OPC Driver**. To configure it, right-click this object and select the **Select server** item.



Select server option

The following window is then displayed, allowing to select an OPC UA server on a local machine or on a network.



Local and network OPC UA servers

For each OPC UA server, locally or on a network, endpoints are enumerated, which can use different protocols and security modes. In addition, for each endpoint a server can also support different ways of identifying and authenticating users.

Currently, E3 allows a connection only using the **Binary TCP** mode. For this mode, E3 supports security modes defined by the OPC UA standard, with several combinations of security policies. For authentication, E3 only supports **Anonymous** and **User and Password** modes.

NOTE: The OPC UA Servers window lists all protocols and security modes, for user information. However, only E3 compatible modes can be selected.

When selecting an E3 compatible endpoint, the **EndPointURL**, **SecurityMode**, and **SecurityPolicy** properties of this object are automatically filled in.

If the **UserName** and **Password** properties of this object are left blank, E3 uses an

anonymous connection with a server. Otherwise, E3 sends these property values to a server, which must support that type of authentication on the selected endpoint.

In this object it is also possible to configure several timeouts for an OPC UA connection. These timeout limits (the **TimeoutCall**, **TimeoutConnection**, and **TimeoutSession** properties) are always in milliseconds and they must be set according to communication performance, which may be limited by a server, by a network, by machines running a client and a server, and even by operations performed on a client. These settings must be performed on a case-by-case basis, and these property values are only suggested.

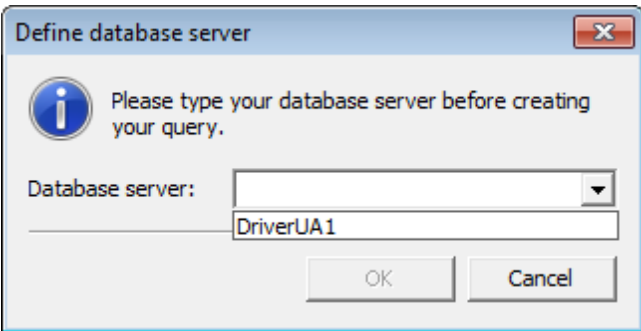
In E3 Studio, communication with a Driver can be activated by selecting the **Activate Communication** option on object's contextual menu. Activation is performed automatically by Query objects when selecting servers, Tags, or when performing a visualization of query results (the **Visualize** tab).

Notice that to edit Driver properties it may be necessary to deactivate communication. If communication is active in E3 Studio, then it is possible to open a window with information about the selected server (by selecting the **Server information** option on object's contextual menu). In case a connection is not established, for any reason, this window displays question marks instead of server information.

4.4.2 Query Object

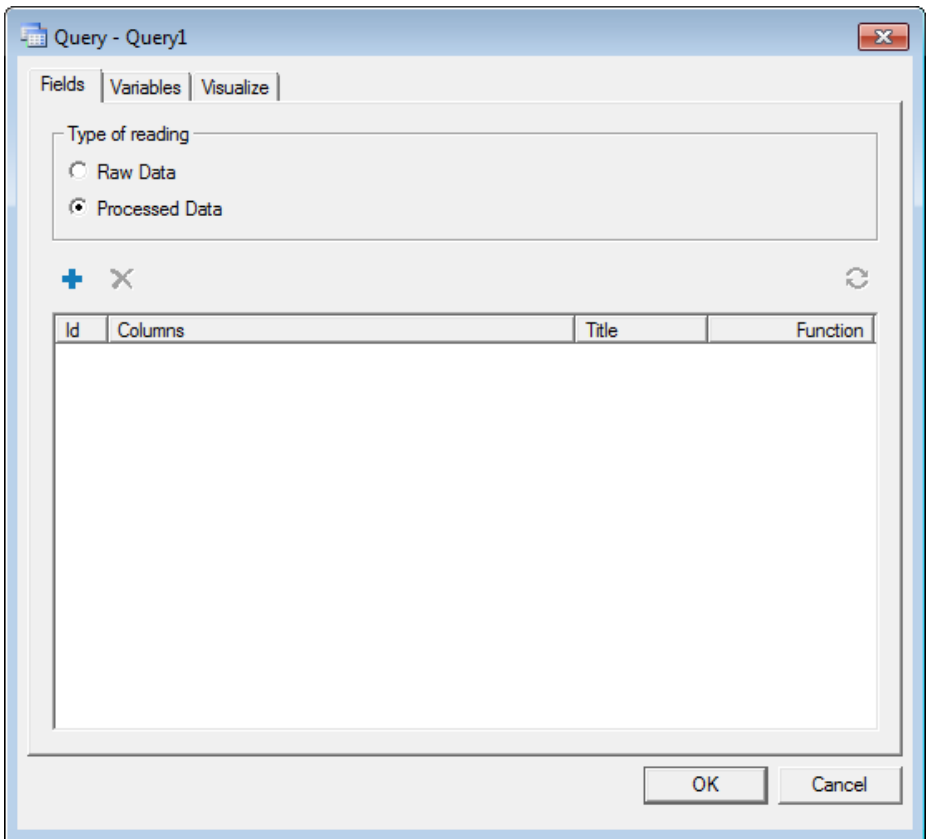
To configure a Query object to retrieve data from an OPC UA server using an OPC UA Driver, follow these procedures:

1. Select an OPC UA Driver on Query's Define database server window.



Select an OPC UA Driver

2. The following window is then displayed, allowing a Query configuration.







Fields tab

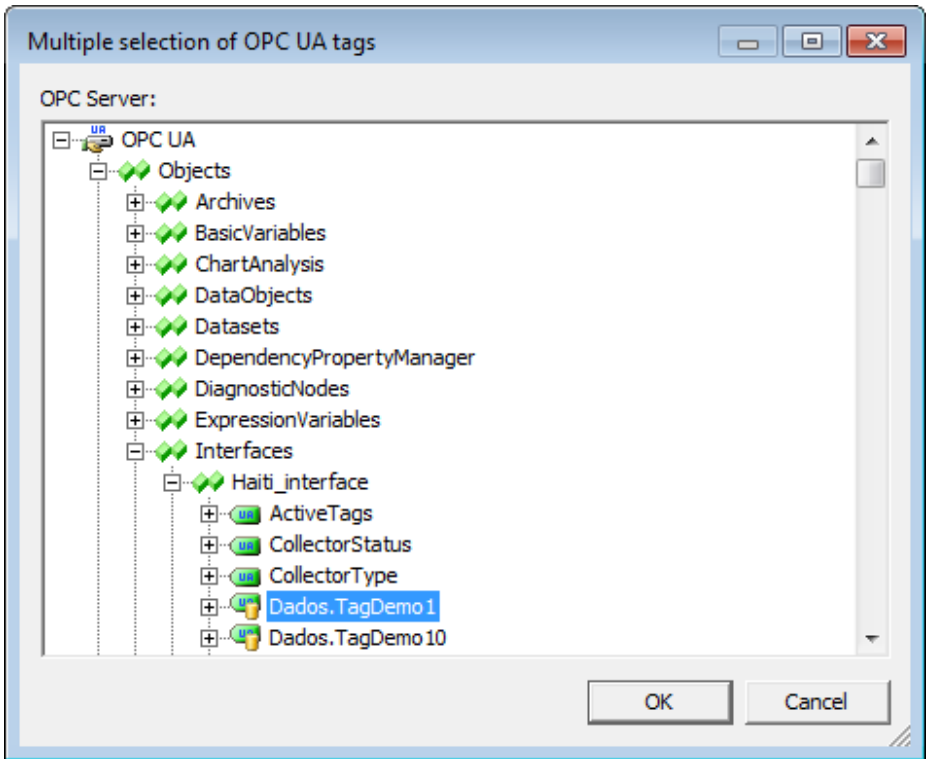
The available options on **Fields** tab are described on the following table.

Available options on Fields tab

OPTION	DESCRIPTION
Raw Data	This Query returns data as stored on a server, similar to Storage's CompressedDataStartTime query. In this mode, only one Tag can be retrieved at a time, and it also returns this value's quality.

OPTION	DESCRIPTION
Processed Data	This Query returns aggregated data inside a time interval, similar to Storage's SampledData and CalculatedData queries. In this mode, several Tags can be retrieved at once, although not returning this value's quality. Several aggregation functions can be used, such as average, maximum, interpolation, etc. Different functions can be used for each Tag and one Tag can appear several times in a Query, with different aggregation functions. E3 only lists standard functions, without searching for server's specific functions or filtering functions not supported by a server. This Query may fail when selecting a function not supported by an OPC UA server.
	Adds one or more Tags from an OPC UA server.
	Removes the selected Tag from this Query.
	Forces an update on OPC UA Node Identifier (NodeId) values.
Id	Type of OPC UA Node Identifier (NodeId) on a server.
Columns	Path of a Tag on an OPC UA server.
Title	Name of a Tag on an OPC UA server.
Function	Function used on this Tag. This column is only available when the Processed Data option is selected.

When clicking , the following window is then displayed, allowing to select the existent Tags on a server.



Selecting OPC UA Tags

The **Variables** and **Visualize** tabs have the same behavior described on **Query** chapter.

4.4.3 Certificates

During E3 installation, a certificate relative to this instance of an E3 OPC UA client is installed. This certificate is needed whenever using a connection with a server whose security mode (the **SecurityMode** property) is not equal to **None** (that is, a secure OPC UA connection).

This certificate can be found on **CertificateStore/certs** folder of E3 installation, as a file called Elipse E3 UA Client [xxx].der, where xxx is a random-generated code.

If this certificate is deleted, a new one is automatically generated whenever an OPC UA Driver tries to establish a connection with a server.

NOTES:

- Deleting a certificate may imply in updating OPC UA servers with a new certificate, or else a secure connection with E3 client may be denied.
- This certificate corresponds to client's instance, not to E3's OPC UA client, that is, it **CANNOT** be copied from one machine to another. Every installation has its unique certificate.
- E3's OPC UA client accepts any valid server certificate, that is, no configuration is needed for E3 client to accept a certain instance of an OPC UA server.

4.4.4 Limitations on Reading Data Types

E3 OPC UA Driver supports basic data types and one-dimension arrays, as well as a few types of structures defined by the OPC UA standard. The following types of scalar values and arrays are supported:

- **Fully-supported types:** **SByte**, **Byte**, **Int16**, **UInt16**, **Int32**, **UInt32**, **Int64**, **UInt64**, **Float**, **Double**, **Boolean**, **String**, **DateTime**, and **ByteString**
- **Supported types with limitations:** **DataValue** (ignores timestamp and quality), **LocalizedText** (ignores locale), **QualifiedName** (ignores *NamespaceIndex*), **StatusCode** (converted to **SCode** or **HRESULT**), **Guid** (converted to text)
- **Supported types converted to one-dimension arrays with fixed size:** These data types are returned as arrays of **Variants**, where each one of these fields is an array item. If a field is another object, **Variant** contains another array, and so on. Supported types are **ServerDiagnosticsSummaryDataType**, **SubscriptionDiagnosticsDataType**, **SessionSecurityDiagnosticsDataType**, **SessionDiagnosticsDataType**, **ApplicationDescription**, **Argument**, **BuildInfo**, **ServiceCounterDataType**, **ExpandedNodeId**, and **NodeId**

In query fields, text of Tag paths follows OPC UA standard for relative paths. Components of this path are the following:

- **/ (slash mark):** Indicates any hierarchical reference
- **. (period):** Indicates any aggregation reference
- **[ns:]browse-name:** A **String** that follows a slash mark or period specifies a browse name of an item. This name can be prefixed with its Namespace index. If omitted, assumes a value of 0 (zero)
- **& (ampersand, escape character):** Inserts a reserved character in place. For example, an expression "&/Name" is replaced by "/Name". Reserved characters are the following:
 - **/ (slash mark)**
 - **. (period)**
 - **< (less than)**

- > (greater than)
- : (colon)
- # (number sign)
- ! (exclamation point)
- & (ampersand)

A formal definition of an OPC UA path, in BNF notation, is the following:

```

<relative-path> ::= <reference-type> <browse-name>
  [<relative-path>]
<reference-type> ::= '/' | '.' | '<' ['#'] ['!']
  <browse-name> '>'
<browse-name> ::= [<namespace-index> ':' ] <name>
<namespace-index> ::= <digit> [<digit>]
<digit> ::= '0' | '1' | '2' | '3' | '4' | '5'
  | '6' | '7' | '8' | '9'
<name> ::= (<name-char> | '&' <reserved-char>)
  [<name>]
<reserved-char> ::= '/' | '.' | '<' | '>' | ':'
  | '#' | '!' | '&'
<name-char> ::= All valid characters for a String
  excluding reserved-chars
  
```

E3 does not support OPC UA Node Identifiers (NodeIds) that do not belong to a server where Tag browsing is performed (Gateway servers). These Tags, therefore, are not displayed on a window for selecting servers. In addition, paths are always hierarchical and only **slash mark (/)** and **period (.)** reference types are supported (the **<browse-name>** type is not supported).

4.5 Quality

Quality fields represent quality status of an item's value. They are formed by a 16-bit word, and the first eight bits are defined by three bit fields: **Quality**, **Substatus**, and **Limit**.

The other eight bits (of a higher order) are available for each manufacturer's usage. If these bits are used, default quality bits are still used to indicate which deductions could be made on returned data. So, it is client's responsibility to interpret specific information field on quality, to ensure that a server providing this information uses the same rules as a client.

Available options on Quality field

QUALITY	QUALITY FIELD	DESCRIPTION
0 - 63	Bad	This value cannot be used for the reasons indicated in the Substatus field.

QUALITY	QUALITY FIELD	DESCRIPTION
64 - 127	Uncertain	This value's quality is uncertain for the reasons indicated in the Substatus field.
128 - 191	(Reserved)	Not used by the OPC standard.
192 - 255	Good	Value's quality is good.

A server that does not support information on quality always returns 192 (Good). It is also acceptable that a server simply returns 0 or 192 (Bad or Good) and always returns 0 (zero) for **Substatus** and **Limit**.

4.5.1 Substatus Field

This field's layout depends on **Quality** field.

Substatus for BAD Quality

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Non-specific	This value is bad, but no specific reason is known.	0	1	2	3
Configuration Error	There is some specific configuration problem in a server. For example, this specific item may have been deleted.	4	5	6	7

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Not Connected	Input must be logically connected to something, but it is not. This quality may reflect that no value is available at that time, because this value may have not been provided by a data source.	8	9	10	11
Device Failure	A device failure has been detected.	12	13	14	15
Sensor Failure	A sensor failure has been detected (the Limit field may provide additional information).	16	17	18	19
Last Known Value	Communication have failed. However, the last known value is available. Notice that this value's age may be determined by the Timestamp property.	20	21	22	23

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Communication Failure	Communication have failed. There is no last known value available.	24	25	26	27
Out of Service	Block is off scan, or locked.	28	29	30	31
N/A	Not used.	32 - 63			

Substatus for UNCERTAIN quality

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Non-specific	There is no specific reason.	64	065	066	067

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Last Usable Value	A device providing this value has stopped doing so. The returned value must be considered as <i>old</i> . Notice that this differs from a Bad value with Substatus 5 (last known value). That status is associated specifically with a detectable communication error on a retrieved value. This error is associated with a failure of some external source that would insert something into this value within an acceptable period of time. Notice that this value's age can be determined by the Timestamp property.	68	069	070	071
N/A	Not used.	72 - 79			

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Sensor Not Accurate	Either this value has been stuck at one of sensor's limits (in which case the Limit field should be set to 1 or 2) or this sensor is otherwise known to be out of calibration, via some internal diagnosis (in which case the Limit field must be zero).	80	81	82	83
Engineering Units Exceeded	The returned value is outside the limits defined for this parameter. Notice that in this case the Limits field indicates which limit has been exceeded, but does not necessarily imply that this value cannot move outside the specified range.	84	85	86	87

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Sub-Normal	This value is derived from multiple sources, and there is a smaller number of good sources.	88	89	90	91
N/A	Not used.	92 - 127			

NOTE: Servers that do not support **Substatus** must return 0 (zero).

Substatus for GOOD Quality

SUBSTATUS	DESCRIPTION	LIMIT			
		NO LIMIT	LOW	HIGH	CONSTANT
Non-specific	This value is good. There are no special conditions.	192	193	194	195
N/A	Not used.	196 - 215			
Local Override	Typically indicates that an input was disconnected, and a manually-entered value has been forced.	216	217	218	219
N/A	Not used.	220 - 255			

NOTE: Servers that do not support **Substatus** for good quality must return 0 (zero).

4.5.2 Limit Field

The **Limit** field is valid regardless of **Quality** and **Substatus** fields. In some cases, such as a failure on a sensor, it may provide diagnosis information.

Limit Field

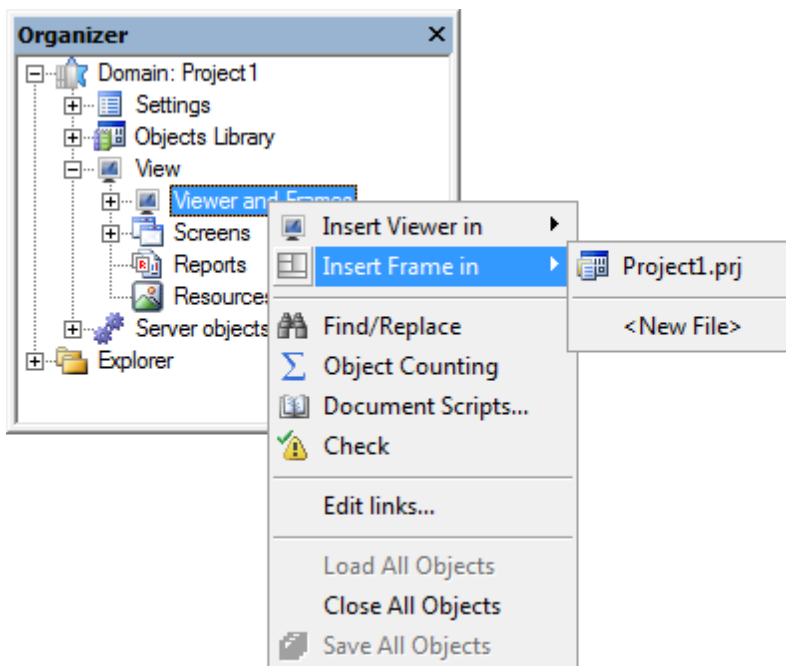
SPECIFICATION	DESCRIPTION
Not Limited	This value is free to move up or down.

SPECIFICATION	DESCRIPTION
Low Limit	This value is limited at some lower limit.
High Limit	This value is limited at some higher limit.
Constant	This value is a constant and cannot move up or down.

NOTE: Servers that do not support the **Limit** field must return 0 (zero).

A **Frame** object is used to organize and structure project's interface, creating composed views for users inside Viewer's or browser's main window. Many times, an application requires only a main Screen, which is the doorway to an application. From then on, users can browse other Screens, which replace the first one, unifying the process view. However, it is possible to support more than one view in the same document or the same project. This is useful when an application uses a Screen that never changes, or has little changes (such as a menu, for example), and another part that is a Screen's browsing area. To use this resource, follow this procedure:

1. Right-click a project's name in Explorer and select the **Insert - Frame** option. In **Domain** mode, right-click the **View - Viewer and Frames** item, select the **Insert Frame in** option, and then the project's name.



Inserting a Frame in Domain mode

Frames have subdivisions, called **Splitters**, which can be inserted or removed from a Frame by right-clicking its Design view. Initially, a Frame has one main Splitter, which can be further subdivided either horizontally or vertically into two or more Splitters, and so on.






For each new pair of Splitters created by the **Split Horizontally** and **Split Vertically**

options, there is always a Main Splitter and a Secondary Splitter. Only a Main Splitter have values that explicitly define its position, and a Secondary Splitter gets the remaining value.

So, when a Splitter is subdivided horizontally, its **SplitDockPosition** property gets the **dockTop** value. Likewise, if a subdivision is vertical, this property gets the **dockLeft** value. A Secondary Splitter's property then gets the **dockRemaining** value, which means it occupies the remaining space.

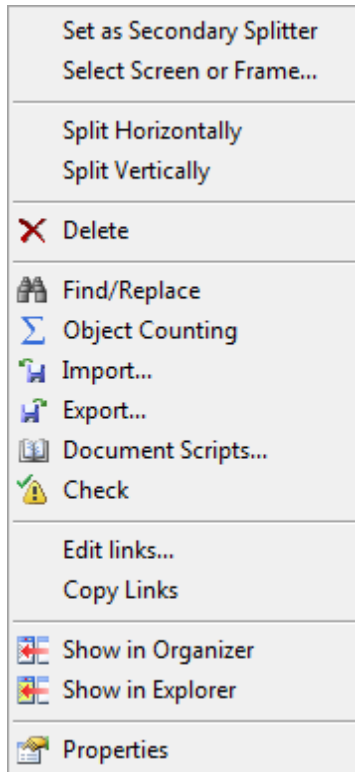
The Organizer's object icons identify the exact position of every Splitter.

Splitter positioning options

ICON	DESCRIPTION
	dockBottom: This Splitter is below the parent Splitter.
	dockTop: This Splitter is above the parent Splitter.
	dockLeft: This Splitter is on the left of the parent Splitter.
	dockRight: This Splitter is on the right of the parent Splitter.
	dockRemaining: This Splitter occupies the remaining space after positioning its sibling Splitter.

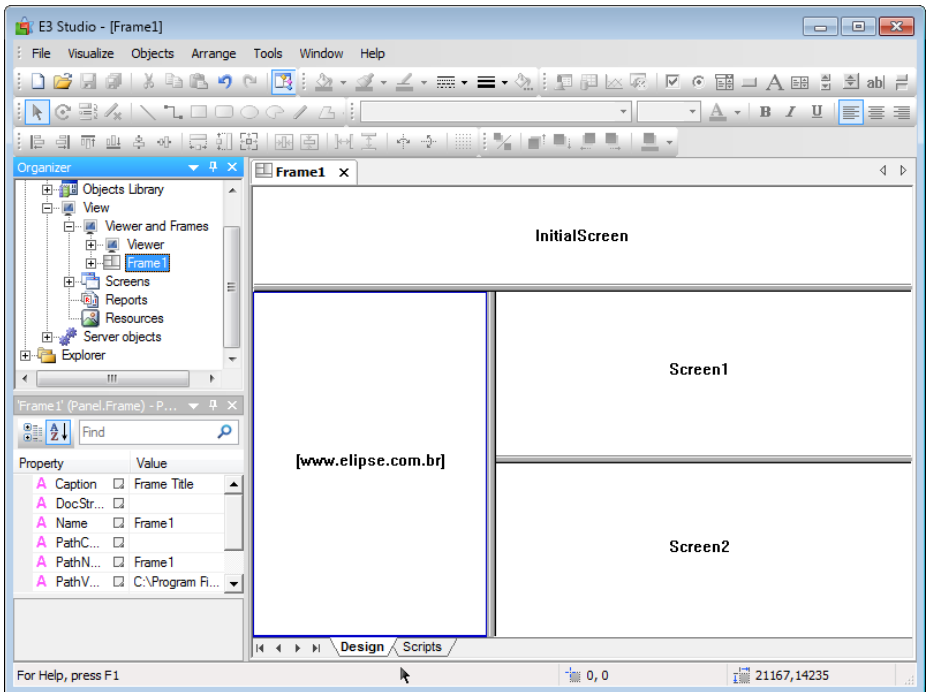
Every Splitter corresponds to a view of a Screen or Frame of a process, or to a URL (*Universal Resource Locator*). To use this resource, follow these procedures:

1. Right-click an open Frame and select one of the options: **Split Horizontally** or **Split Vertically**, according to Splitter's type.



Inserting a Horizontal or Vertical Splitter

2. To remove a Splitter, right-click an open Frame and select the **✗ Delete** option.
3. Users can invert a Splitter's original selection (turn a Main Splitter into a Secondary Splitter, and vice versa) using the same menu. In a Main Splitter, right-click a Frame and select the **Set as Secondary Splitter** option. In a Secondary Splitter, select the **Set as Main Splitter** option. Splitters' **SplitDockPosition** property is automatically configured to reflect this change.
4. With the **Select Screen or Frame** option, users can select a Screen or Frame to link to Splitter's **SplitLink** property, via AppBrowser.
5. Users can insert as many Splitters as needed in a Frame.



Frame Splitters

6. To configure Frame Splitters, right-click the Organizer on a Splitter and select the **Properties** option.

The screenshot shows a window titled "'Top' properties (Panel.FrameSet)". It has three tabs: "Item", "Frame", and "Links". The "Frame" tab is active. Inside the tab, there are several configuration options:

- Screen or Frame:** A text field containing "InitialScreen" with a small button to its right.
- Zoom:** A dropdown menu.
- Enable scrollbar in Initial Screen:** A checkbox that is checked.
- Placing:** A dropdown menu showing "dockTop".
- Value:** A text field containing "3413.13".

Frame configurations

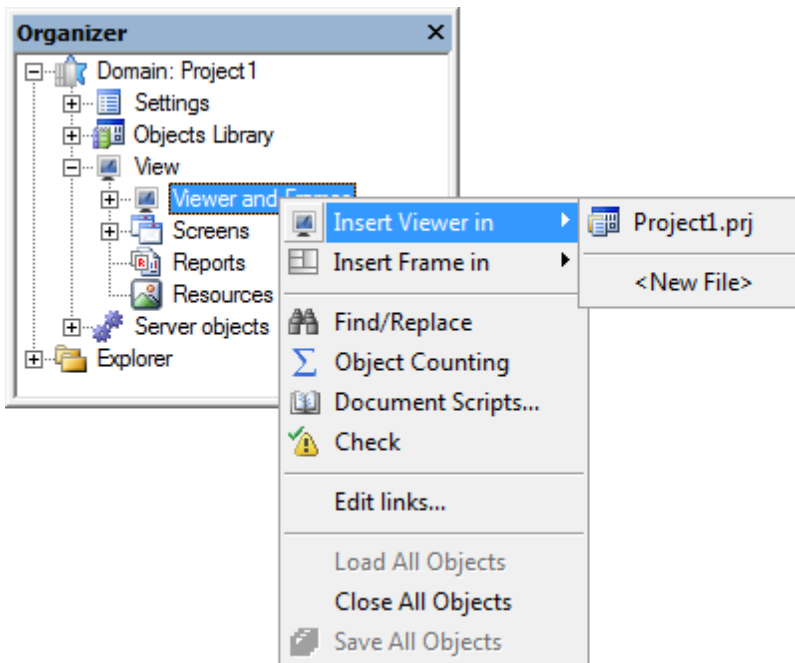
The available options are described on the next table.

Available options for Frame tab

OPTION	DESCRIPTION
Screen or Frame	Determines either a Screen or a Frame to be opened by a Splitter. It is only enabled if a Splitter has no children. This field is equivalent to the SplitLink property.
Placing	Determines Splitter's position on a Frame. This field is equivalent to the SplitDockPosition property.
Value	Determines the value to attribute to a Frame. It is only visually effective if modified in a Main Splitter. This field is equivalent to the SplitValue property.

Some Frame or Splitter properties can be configured via Properties List, with no need for creating scripts. To configure any property, locate it on Properties List and perform the necessary adjustments. For further information, please check the **Scripts Reference Manual**.

The **Viewer** is the object performing application viewing. With it, users can view Screens at run time, as well as manipulate the application. It can run from anywhere on the network with access to an E3 Server. It is not necessary to copy the application to other Viewers, because Screens and bitmaps are downloaded at run time as needed. There can only be one Viewer per Domain.



Viewer in Domain mode

To create a Viewer in the project, follow these procedures:

1. Check if there is already a Viewer in the Domain, or insert a new one, by right-clicking the project's name in Explorer, and then selecting the **Insert - Viewer** option. In **Domain** mode, right-click the **View - Viewer and Frames** item, select the **Insert Viewer in** option, and then the project's name.

NOTE: The drawing quality of Screens can be modified, at run time, by using Viewer's contextual menu, and then selecting one of the options of the **Quality (all screens)** menu. For more information, please check the Viewer's **RenderQuality** property, on **Scripts Reference Manual**.

6.1 Configuration

By using Viewer properties, users can specify Viewer configurations, Communication errors, and create Links or scripts.

6.1.1 E3 Viewer

On **E3 Viewer** tab, users can configure Viewer's title, Screen, and zoom, as well as other properties, as explained next.

'Viewer' properties (Panel.Viewer)

Item

E3 Viewer

Settings

Communication errors

Links

Title:

E3 Viewer Application

Initial Screen or Frame:

InitialScreen

...

Zoom:

☒ Enable scrollbar in Initial Screen

☒ Show Zoom menu when right-clicking

☒ Keep Screens loaded on memory

☐ Inactivity time (minutes):

5

Number of retries for user/password confirmation

2

KeyPad

☐ Show when a SetPoint gets focus

☐ Hide when pressing ENTER


☐ Hide when pressing ESC

E3 Viewer tab

Each field on **E3 Viewer** tab has a corresponding property. The available options are:

Available options for E3 Viewer tab

OPTION	DESCRIPTION
Title	Determines Viewer's title. This field is equivalent to the Viewer's Caption property.

OPTION	DESCRIPTION
Initial Screen or Frame	Determines Viewer's initial Screen or Frame. By clicking  , the application opens the AppBrowser, where users can select the initial Screen. This field is equivalent to the Viewer's InitialScreen property.
Zoom	Determines Viewer's zoom level. By selecting one of its options, it is possible to configure how Viewer will be initialized. This field is equivalent to the Viewer's InitialScreen property, and it is represented by the specifications after the character "?". For example, if the zoom on initial Screen is 100%, then the InitialScreen property displays <code>InitialScreen?100</code> , where <code>InitialScreen</code> is the Screen's name, and <code>?100</code> is its zoom percentage.
Enable scrollbar in Initial Screen	Enables a scroll bar on the initial Screen.
Show Zoom menu when right-clicking	Enables the display of the Zoom menu when right-clicking the Screen at run time. This field is equivalent to the Viewer's EnableZoomMenu property.
Keep Screens loaded on memory	Enables Viewer to keep the loaded Screens in memory. This field is equivalent to the Viewer's CacheEnable property.
Check for inactivity after ... minutes	Defines the maximum time, in minutes, to wait for a mouse or keyboard event for the inactivity period. This field is equivalent to the Viewer's EnableInactivity property.
Number of retries when entering user name and password	Establishes the number of times the login dialog box will be displayed, in addition to the first time. This field is equivalent to the Viewer's LoginRetries property.

6.1.2 Settings

Using the **Settings** tab, users can configure Viewer's window, title, and resolution.

'Viewer' properties (Panel.Viewer)

Item | E3 Viewer | **Settings** | Communication errors | Links

Viewer's window

☒ Start maximized
☐ Start minimized
☐ Start windowed

Width (pixels): 400
Height (pixels): 300

☒ Centralize window
☐ Disable task switching

Viewer's title

<input checked="" type="checkbox"/> Title bar	<input checked="" type="checkbox"/> Border
<input checked="" type="checkbox"/> Close button	<input checked="" type="checkbox"/> Sizing border
<input checked="" type="checkbox"/> Minimize button	<input checked="" type="checkbox"/> Move window
<input checked="" type="checkbox"/> Maximize button	<input type="checkbox"/> Always on top
	<input type="checkbox"/> Small titlebar

Viewer resolution

1024 x 768 ▼ Advanced...

Setting tab

Each field on the **Settings** tab has a corresponding property. The available options are:

Available options for Settings tab

OPTION	DESCRIPTION
Start Maximized / Minimized / Windowed	Determines how Viewer's window will start. This field is equivalent to the Viewer's WindowStyle property, and has the following options: <ul style="list-style-type: none"> • 0 - Maximized: Screen starts maximized • 1 - Windowed: Windowed style, that is, Screen's height and width are configurable • 2 - Minimized: Screen starts maximized
Disable task switching	Disables window switching. This field is equivalent to the Viewer's DisableTaskSwitching property. This option can be modified at run time by using the Frame's SetDisableTaskSwitching method.
Title bar	Enables a title bar. This field is equivalent to the Viewer's TitleBar property.
Close	Enables a close button. This field is equivalent to the Viewer's CloseButton property.
Minimize	Enables a minimize button. This field is equivalent to the Viewer's MinimizeButton property.
Maximize	Enables a maximize button. This field is equivalent to the Viewer's MaximizeButton property.
Border	Enables a border around the Viewer's window. This field is equivalent to the Viewer's WindowBorder property.
Sizing border	Indicates if the window can be resized. This options only works if the Border option is selected. This field is equivalent to the Viewer's WindowResizable property.
Move window	Indicates if the window can be moved. This field is equivalent to the Viewer's WindowMovable property.
Always on top	Indicates if the window must be always on top of other windows. This field is equivalent to the Viewer's WindowStayOnTop property.
Small titlebar	Enables a small title bar on the window. This option only works if the Title bar option is selected. This field is equivalent to the Viewer's WindowSmallTitle property.
Screen resolution	Selects a Screen resolution: 640 x 480, 800 x 600, 1024 x 768, 1280 x 1024, or 1600 x 1200.
Advanced	Opens a window for advanced settings.

By clicking **Advanced**, the following window then opens:

Advanced settings

Screen resolution in pixels

☐ Use current computer's resolution

☒ Use user-defined resolution

Horizontal: 1024

Vertical: 768

Deduction on Screen resolution, in pixels

☒ Use current computer's settings

☐ Use user-defined settings

Horizontal: 0

Vertical: 62

Monitor resolution in dots per inch (DPI)

☒ Use current computer's resolution

☐ Use user-defined resolution

Horizontal: 96

Vertical: 96

OK

Cancel

Advanced settings

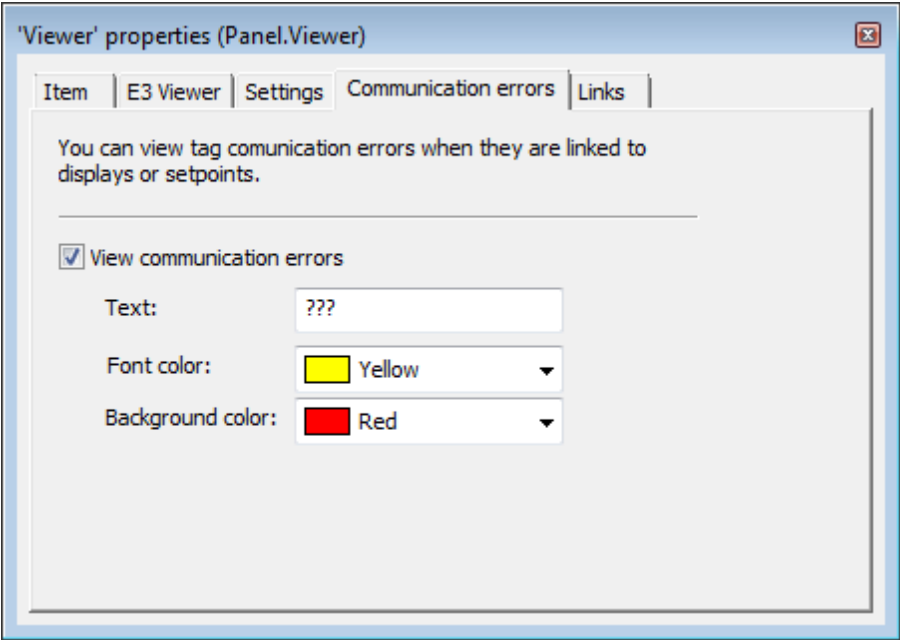
The available options for this window are:

Available options for Advanced settings window

OPTION	DESCRIPTION
Screen resolution in pixels	Allows users to choose from the current computer's resolution, or from any other user-defined resolution, in pixels.
Deduction on Screen resolution, in pixels	Allows users to choose the deduction on Screen's resolution from the current computer settings, or from any other user-defined settings, in pixels.
Monitor resolution in dots per inch (DPI)	Allows users to choose from the current computer's resolution, or a user-defined resolution, in dots per inch (DPI).

6.1.3 Communication Errors

On Viewer, users can view Tag communication errors when they are linked to Displays or Setpoints. This is possible by configuring information on the **Communication errors** tab, available in Viewer Properties.



Communication errors tab

The available options for this tab are:

Available options for Communication errors tab

OPTION	DESCRIPTION
View communication errors	Enables or disables the visualization of communication errors.
Text	Contains the text to be displayed in the Setpoint, in case of a bad value quality.
Font color	Contains the color for the text.
Background color	Color for the Setpoint. It is equivalent to change the Setpoint's ForegroundColor property, but this change is not performed effectively. The Setpoint's property value is not changed.

6.2 Variables in Viewer

In a Viewer object, users can create Links to objects from Screens, as well as use them via scripts. Users can also insert Counter, Demo, Internal, and Timer Tags in

Viewer, in addition to Viewer Folders and Queries. By using the AppBrowser, users can perform the following actions:

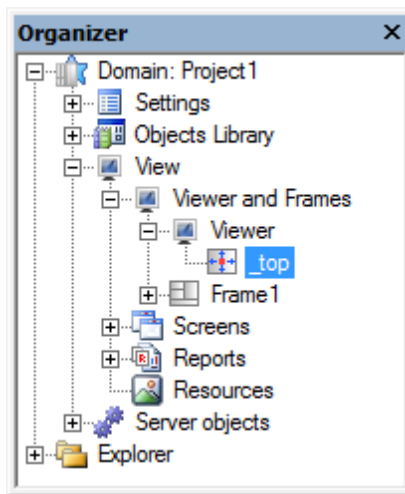
- Access Viewer or one of its child objects from a Screen or a Screen control (Links or scripts)
- Viewer's child objects can access other Viewer's children, or Viewer itself (Links or scripts)
- Viewer can access its own child objects (Links or scripts)

It is important to notice that a Link to a Viewer must use its real name (for example, "Viewer1") and not simply "Application". In scripts, users can still use **Application**, which is a property of all objects returning a Viewer.

6.3 _top Object

Whenever a Viewer is inserted in a project, it then provides a child Frame, called **_top**. This object has the same functionality of the Frame's Splitter object. To use this resource, follow these procedures:

1. Click the Viewer object. The Viewer then displays a child object called **_top**.



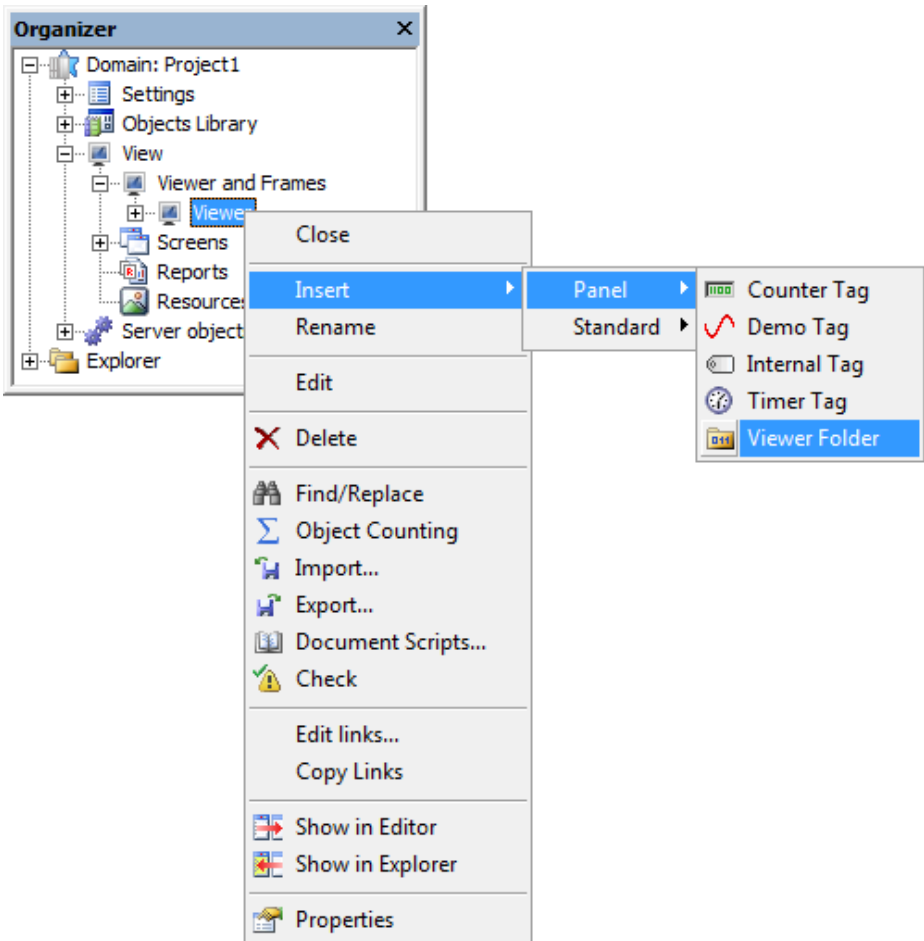
_top object

2. To configure the properties of the **_top** object, right-click it and select the **Properties** option.
3. This object has the same properties of a Frame's Splitter, and such information can be found on chapters **Screens** and **Frames**.

6.4 Viewer Folder

A **Viewer Folder** defines groups inside Viewer objects to organize Viewer Tags (Counter, Demo, Internal, and Timer) and Queries. If needed, new Folders can be inserted into other Folders. To use this feature, follow this procedure:

- 1. Right-click the **View - Viewer and Frames - Viewer** item and select the **Insert - Panel - Viewer Folder** option.



Inserting a Viewer Folder

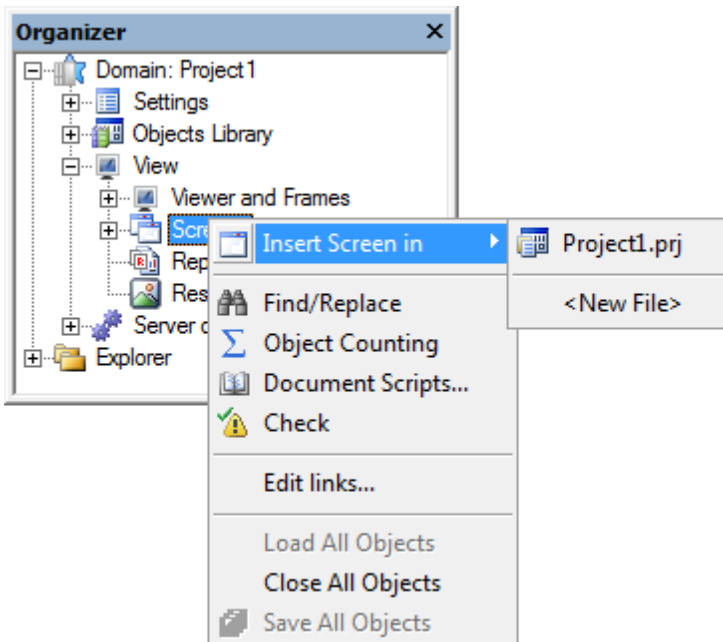
NOTE: An application that contains Viewer Folders cannot be opened on versions of E3 earlier than 3.1.

Screens are windows for monitoring processes. On each Screen users can insert objects to compose the operator's interface with the system, called **Screen Objects**. Each application can have an unlimited number of Screens and Screen objects.

7.1 Screen

The **Screen** is the basic object for interfacing with the user, and it can contain several objects. Graphics inserted on the Screen can be deleted, copied, moved, resized, grouped, or configured.

To insert a new Screen in the project, right-click the project's name in Explorer and select the **Insert - Screen** option. In **Domain** mode, right-click the **View - Screens** item, select the **Insert Screen in** option, and then the project's name.



Inserting a Screen in Domain mode

Whenever a new Screen is created, or when the **Fit to Splitter** option is selected on an existing Screen, the following window is displayed to configure the object's size:

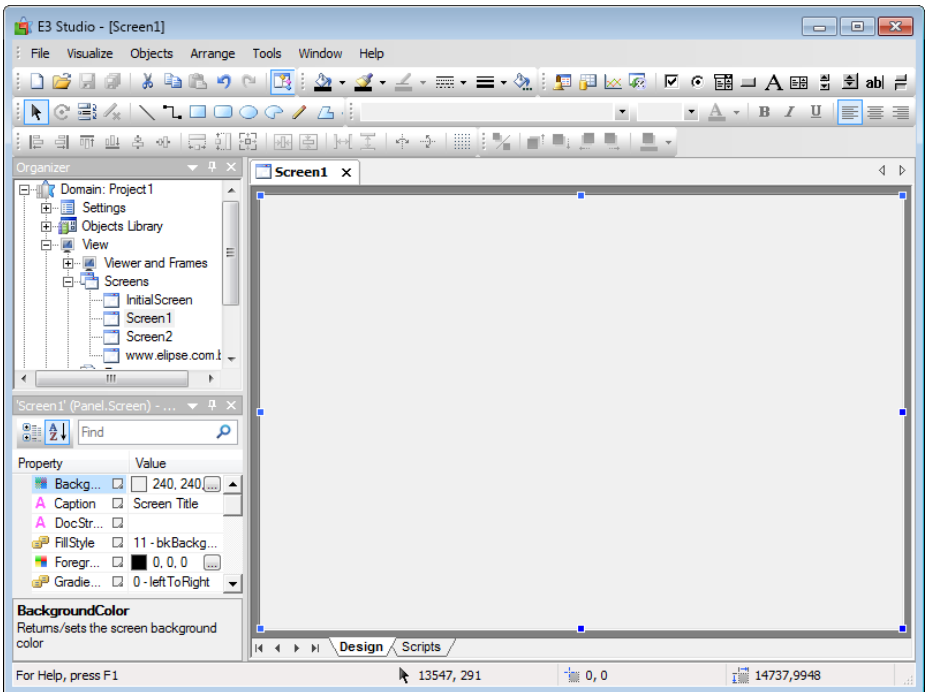
Configuring the Screen size

Available options for Configuring Screen size window

OPTION	DESCRIPTION
Choose the Splitter where the Screen must be opened	Allows choosing the Splitter where the Screen will be opened. The only Splitters listed here are the ones which Screens linked to the SplitLink property will be visible at run time.
Set as initial Splitter's Screen	Sets this Screen as initial Splitter Screen.
Name	Determines the Screen's name.
Width	Determines the Screen's width, in pixels.
Height	Determines the Screen's height, in pixels.

The **Width** and **Height** options are initially filled in with the necessary Screen size to be displayed in the chosen Splitter, with no need for scroll bars. If any of these values is negative, this would mean that the Splitter is not visible at run time, according to the Viewer's configuration and the size of other Splitters.

E3 Studio has an editor for the objects that can be inserted on a Screen. The following objects are available: Line, Rectangle, Round Rectangle, Ellipse, Arc, Freehand, Polygon, Curved Polygon, Figure, Text, Display, SetPoint, Scale, and MSForms. MSForms will be discussed in the next chapter (**ActiveX**). All other objects are presented in this chapter.



Screen

Users can configure Screen properties to determine size, color, and other behavior and appearance aspects, in addition to many types of events. This object's standard measurement and coordinate system use HIMETRIC units, given as 1/100 mm, and not in pixels.

All Screen properties can be configured via Properties List, with no need for creating scripts for that. To configure any property, just locate it on the List and perform the necessary adjustments.

NOTE: The drawing quality of a Screen can be modified, at run time, by using Viewer's contextual menu, and selecting one of the options of the **Quality (this screen)** menu. For more information, please see Screen's **RenderQuality** property, on **Scripts Reference Manual**.

7.2 Screen Objects

The following objects can be inserted on a Screen:


- Primitives from the Graphic Editor (Lines, Circles, Rectangles, Polygons, etc.)
- ActiveX controls supplied by Elipse (E3Alarm, E3Browser, E3Chart, and E3Playback)
- ActiveX controls supplied by a third-party

- Non-vectorial images (BMP, JPG, GIF files, etc.)
- Vectorial images (WMF, EMF files, etc.)
- Default Windows controls (List, Combo Box, Scroll bar, etc.)
- EllipseX objects composed by any of the previous objects
- Viewer Folders, Queries, Counter, Demo, Internal, and Timer Tags


The primitives from the graphic editor available in Studio are listed on the next topics. They can be freely rotated or resized, except for the Picture object. After creation, each object remains selected to edit its properties, if needed.

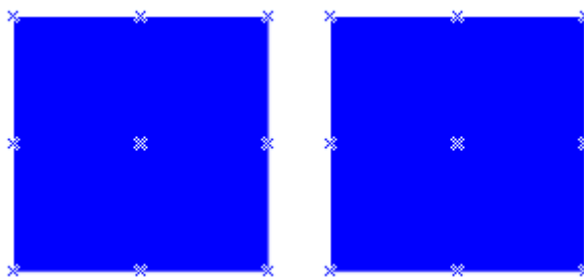
7.2.1 Line

It allows drawing straight lines, connecting two specified points during its creation. To use this object, follow these procedures:



1. Select the Line  on **Screen** toolbar.
2. Click the Screen to create the Line's origin and then drag the mouse until its desired final point.

7.2.2 Connector


This object is used to connect two or more Screen objects by using a line. The Screen objects which can be connected are the Rectangle, the Round Rectangle, the Ellipse, the Arc, the Freehand, the Polygon, and the Curved Polygon. When clicking  on the **Screen** toolbar, the objects previously cited display their connection points, as in the following figure.



Connection points of Screen objects

To connect two objects, just click one of the connection points of the first object and then click one of the connection points of the second one. When moving the mouse pointer over a connection point, its icon changes from  to , indicating which point will be connected.

After creating a Connector, it is also possible to disconnect its vertexes. To do so, drag the vertex away from the object's connection point. To reconnect it, drag it near


to a connection point until its icon changes to .

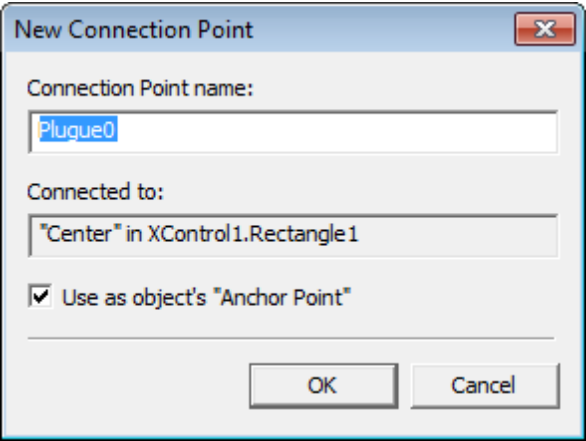
To create a connection among more than two connection points, just keep the CTRL key pressed while selecting all points.

To exclude a Connector, just select it and press the DELETE key. If an object with a Connector is excluded, the Connector is not excluded.

For information about Connectors inside XControls, see the **next** section.

7.2.2.1 Connectors inside XControls

Screen object Connectors created inside XControls must have their connection points defined previously, by clicking  on the **Screen** toolbar. When selecting this tool and clicking a connection point, the window on the next figure is then displayed.



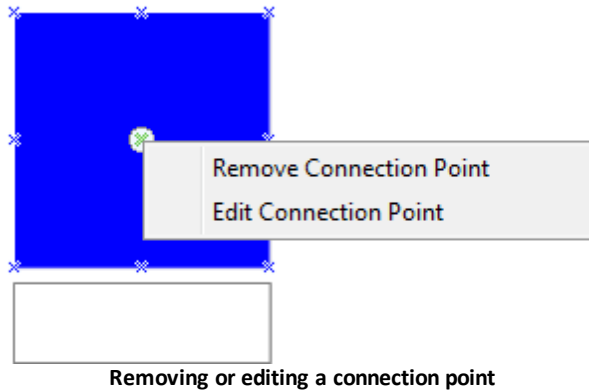
New Connection Point window

The available options on this window are described on the following table.

Available options on the New Connection Point window

OPTION	DESCRIPTION
Connection Point name	Allows defining a name for this Connection Point.
Connected to	Shows to which Connection Point of the Screen object the XControl Connection Point is connected.
Use as object's "Anchor Point"	Selects this Connection Point as object's anchor point. This anchor point can be changed when the XControl is inserted on a Screen. Please check also the topic Anchor Point for more information.


To edit or exclude a previously created point, right-click this point and select the **Remove Connection Point** or **Edit Connection Point** options, according to the next figure. A connection point can also be excluded by clicking it with the CTRL key pressed.



If there is no Connection Point defined for Screen objects inserted in an XControl, there is no way to connect this XControl to any other Screen object, when it is inserted on a Screen.


7.2.3 Rectangle

It allows drawing rectangles, created from two vertexes. To use this object, follow these procedures:

1. Select the Rectangle  on **Screen** toolbar.
2. Click the Screen to create the Rectangle's origin vertex, then drag the mouse diagonally to its final vertex, until the object reaches the desired size and position.


7.2.4 Round Rectangle

It allows drawing rectangles with rounded corners, created from two vertexes. To use this object, follow these procedures:

1. Select the Round Rectangle  on **Screen** toolbar.
2. Click the Screen to create the rectangle's origin vertex, then drag the mouse diagonally to its final vertex, until the object reaches the desired size and position.
3. On the object's upper left corner, there is a dot which is responsible for the rectangle's rounding factor. Dragging it to its center or to its edge to determine its vertex curve.


7.2.5 Ellipse

It allows drawing circles and ellipses. To use this object, follow these procedures:

1. Select the Ellipse  on **Screen** toolbar.
2. Click the Screen to establish the object's initial point, then drag the mouse diagonally until the object reaches the desired size and position.


7.2.6 Arc

It allows drawing arc, cord, or pie-shaped objects. To use this object, follow these procedures:

1. Select the Arc  on **Screen** toolbar.
2. Click the Screen to establish the object's initial point, then drag the mouse diagonally until the object reaches the desired size and position.
3. In the two cutting edges, there will be two points that indicate the object's angle. Drag them to open or close the angle.
4. The initial style of the object is a pie. To change it to an arc or cord, go to the **ArcStyle** property on Properties List.


7.2.7 Freehand

It allows freehand drawings. To use this object, follow these procedures:

1. Select the Freehand  on **Screen** toolbar.
2. Click the Screen to establish the object's initial vertex, and then drag the mouse in any direction as many times as necessary to complete the drawing.


7.2.8 Polygon

It allows drawing straight-sized polygons. To use this object, follow these procedures:

1. Select the Polygon  on **Screen** toolbar.
2. Click the Screen to establish the object's initial vertex, and then drag the mouse in any direction as many times as necessary to complete the drawing.
3. If users want to change the drawing direction, just click it. To finish the drawing, just double-click it.


7.2.9 Curved Polygon

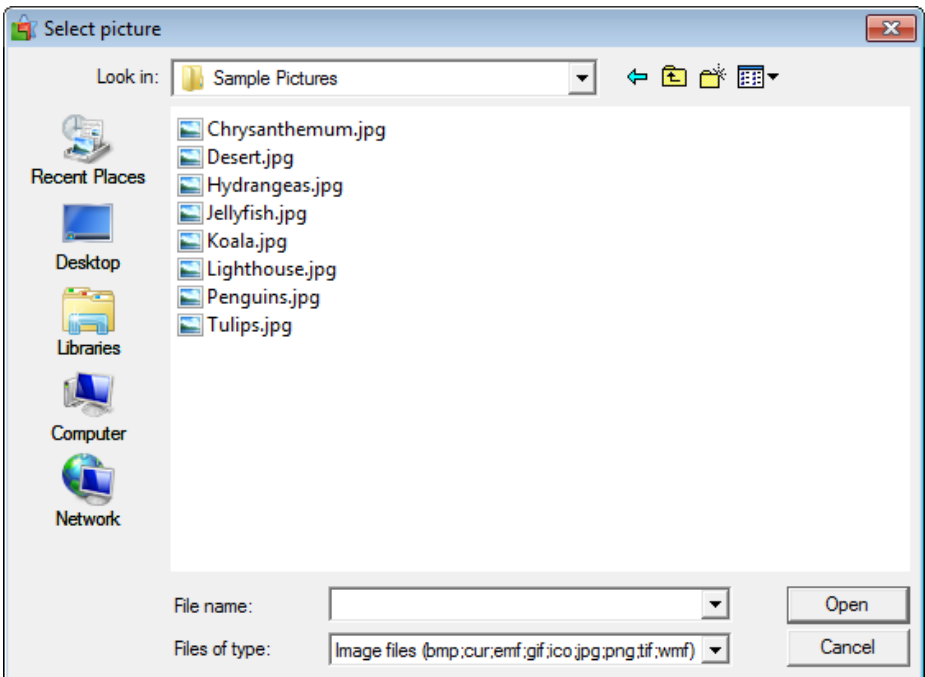
It allows drawing curved-sized polygons. To use this object, follow these procedures:

1. Select the Curved Polygon  on **Screen** toolbar.
2. Click the Screen to establish the object's initial vertex, and then drag the mouse in any direction as many times as necessary to complete the drawing.
3. If users want to change the drawing direction, just click it. To finish the drawing, just double-click it.

7.2.10 Picture

This object allows displaying pictures stored in files, which may or may not belong to an application. A Picture can be freely resized, but rotation and animation are only effective when working with a metafile converted to a symbol. The following file formats are supported: *Bitmap* (.bmp), *Graphics Interchange Format* (.gif), *Joint Photographic Experts Group* (.jpg), *ICO File Format* (.ico), *Windows Metafile* (.wmf), *Enhanced Metafile* (.emf), *Portable Network Graphics* (.png), and *Tagged Image File Format* (.tif). To use this object, follow these procedures:

1. Select the Picture  on **Screen** toolbar.
2. Click a Screen to create this object's origin vertex and drag the mouse pointer diagonally to its final vertex.
3. Studio opens a dialog box to select an image file, according to the next figure.




Selecting an image file

4. Select a file and click **Open** to insert that picture on this Screen.


7.2.11 Text

It allows creating a text to be displayed on Screen. To use this object, follow these procedures:

1. Select the Text  on **Screen** toolbar.
2. Type the desired text, and then press ENTER.
3. To change or type a text in this object, use its **Value** property.


7.2.12 Display

It allows creating an object that displays Tag values at run time. To use this object, follow these procedures:

1. Select the Display  on **Screen** toolbar.
2. Click the Screen to create the object's origin vertex, then drag the mouse diagonally to its final vertex, until the object reaches the desired size and position.
3. Right-click the object to open its Properties window. On the **Item** tab, choose the Tag to be linked to the Display's **Value** property.


7.2.13 SetPoint

This object works as an edit box in which contents are inserted to be attributed to associated Tags. To use this object, follow these procedures:

1. Select the SetPoint  on **Screen** toolbar.
2. Click the Screen to create the object's origin vertex, then drag the mouse diagonally to its final vertex, until the object reaches the desired size and position.
3. Right-click the object to open its Properties window. On the **Item** tab, choose the Tag to be linked to the SetPoint's **Value** property.

7.2.14 Scale

It allows creating an object that draws rulers and value scales. To use this object, follow these procedures:

1. Select the Scale  on **Screen** toolbar.
2. Click the Screen to create the object's origin vertex, then drag the mouse diagonally to its final vertex, until the object reaches the desired size and position.









7.3 General Configurations








The following configurations can be applied to a Screen or to Screen objects.

7.3.1 Alignment

It allows users to align Screen objects, relative to a Screen or to other objects. The available options are described on the next table.

Alignment options for Screen objects

ICON	OPTION	DESCRIPTION
	Align Left	Aligns two or more objects to one another, having the left coordinate of the last selected object as a reference.
	Align Right	Aligns two or more objects to one another, having the right coordinate of the last selected object as a reference.
	Align Top	Aligns two or more objects to one another, having the top coordinate of the last selected object as a reference.
	Align Bottom	Aligns two or more objects to one another, having the bottom coordinate of the last selected object as a reference.
	Align Horizontal Center	Aligns two or more objects horizontally to one another, having the last selected object as a reference.
	Align Vertical Center	Aligns two or more objects vertically to one another, having the last selected object as a reference.
	Same Width	Applies the width of the last selected object to the other selected objects.
	Same Height	Applies the height of the last selected object to the other selected objects.


ICON	OPTION	DESCRIPTION
	Same Size	Applies the size of the last selected object to the other selected objects.
	Center Horizontally	Centers the object on the Screen, according to its horizontal coordinates.
	Center Vertically	Centers the object on the Screen, according to its vertical coordinates.
	Space Across	Applies the same horizontal distance among three or more objects.
	Space Down	Applies the same vertical distance among three or more objects.
	Horizontal Flip	Applies a horizontal reflection effect to the selected objects.
	Vertical Flip	Applies a vertical reflection effect to the selected objects.

NOTE:

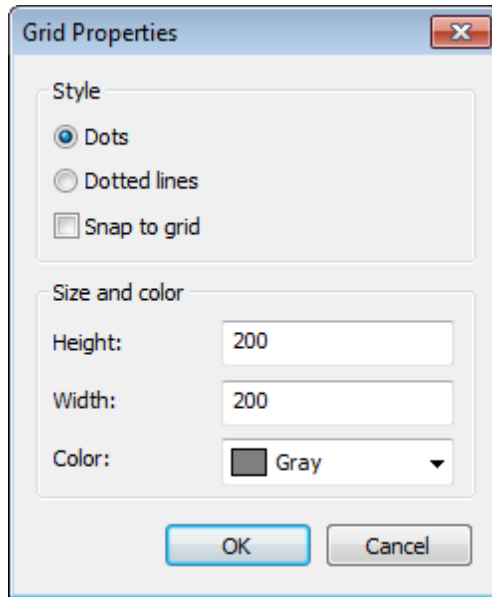
- The **Horizontal Flip** and **Vertical Flip** options have the following behavior:
 - For multiple selections, each one of the objects is individually flipped
 - The status of the buttons (pressed or not) changes according to the vertical or horizontal flipping of the objects, but only if the reflection status is the same for all selected objects
 - Buttons are disabled if the Screen is selected, or if there is no object selected
- Screen objects can be adjusted to the nearest pixel (the *Snap to Pixel* effect), by using the key combination CTRL + SPACEBAR.

7.3.2 Grid

A set of horizontal and vertical lines that work as a reference for placing objects on a Screen. It is only viewed in E3 Studio, and not at run time.

In E3 Studio, users can show or hide the grid via the **Arrange - Grid** menu, or by clicking  on **Alignment** toolbar.

Grid properties can be configured via the **Arrange - Edit Grid** menu. When this option is selected, the following dialog box is displayed:



Grid Properties


The available options are:

Available options for Grid Properties window

OPTION	DESCRIPTION
Dots	The grid shows dots only at line intersections.
Dotted lines	The grid shows the whole line dotted.
Snap to grid	Aligns the mouse to the grid automatically.
Height	Determines the distance between horizontal lines.
Width	Determines the distance between vertical lines.
Color	Determines the grid color.

7.3.3 Rotate


It allows rotating any Screen object that has its origin at its center or at any other point on the Screen. To use this resource, follow these procedures:

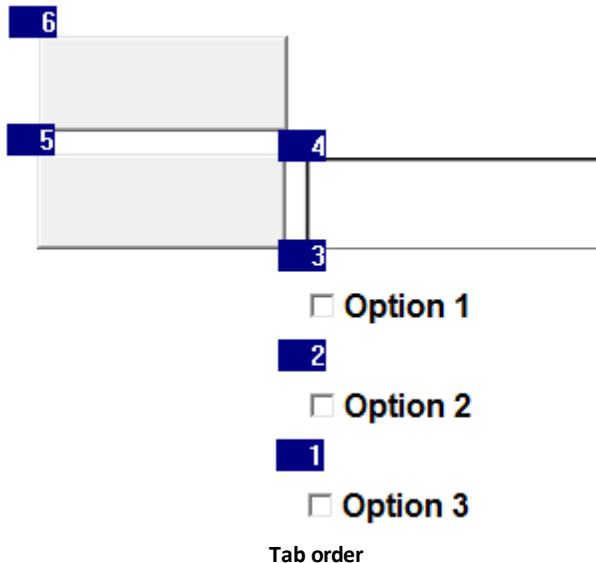
1. Select an object on Screen and click **Rotate**  on **Screen** toolbar.
2. Click one of its rotating vertexes (in green) and drag the object to the desired position.
3. If needed, change the object's rotation center (indicated by a green circle).

NOTE: For Screen objects of type **Picture** that use the Bitmap file format (files with .bmp extension), the rotate feature is not available.


7.3.4 Tab Order among Objects

Establishes a browsing order, via TAB key, among two or more objects at run time (that is, the order in which the objects gain focus). To enable this option, follow these procedures:

1. Select a Screen and click **Tab Order**  on the **Screen** toolbar.
2. Click the objects in the desired order. A number with the browsing order then appears on the upper left side of each object.
3. When the Domain runs, navigation among these objects are then performed in that specified order.





To keep the initial order of the objects, follow these procedures:

1. After creating an object on a Screen, click **Tab Order** .
2. With the CTRL key pressed, click the second-to-last object.
3. Release the CTRL key and then click the last object (the previously created object).

NOTE: The tab order is equivalent to the object's overlaying order, described on topic **Object Overlaying**.

7.3.5 Group or Ungroup


It allows users to turn more than one object into a single one, with specific properties. To use this resource, follow these procedures:


1. Select on Screen the objects that will be part of the group.
2. Click **Group** . A new object is then created. This operation can be performed in cascade, and a group can contain any objects, including other groups.
3. To undo this action, click **Ungroup** .
4. To edit an object contained in a group, right-click the object and then select the **Edit Group** option.

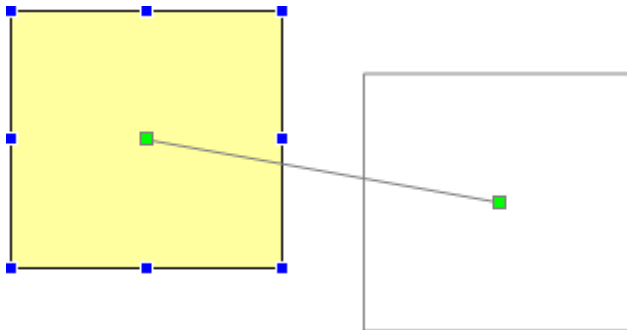
NOTE: It is possible to adjust objects inside a group to the nearest pixel (the *Snap to Pixel* effect), by using the key combination CTRL + SPACEBAR. In this case, the effect is applied to every object inside the group, and it can be undone by using the key combination CTRL + Z.

7.3.6 Animation


A feature that applies movement to an object at run time, which is available on the **Screen** toolbar. The available types of movements are the following:


-  **Linear Slider:** The object receiving this feature performs linear movements according to the configuration of object's properties. To enable this option, follow these procedures:

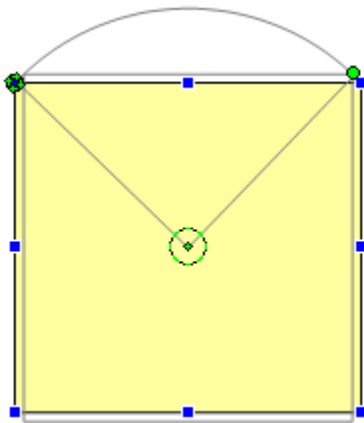
1. Select the object on Screen and click  **Linear Slider**.
2. With the mouse pointer, enable object's orientation configurations.



Linear Slider

-  **Rotation Slider:** The object receiving this feature performs circular movements according to the object's rotation center and its angle. To enable this option, follow these procedures:

1. Select the object on Screen and click  **Rotation Slider**.
2. When the object is created, its default rotation center is defined as its center, with a zero degree horizontal inclination relative to that center. At that time, the vertexes of the selected object are indicated by small circles and its center by two circumscribed circles.
3. When moving the mouse pointer over the center or vertexes, users can change the center by dragging or rotating the object from one of its vertexes relative to the center.





Rotation Slider



NOTE: For Screen objects of type **Picture** that use the Bitmap file format (files with .bmp extension), the animation feature is not available.

7.3.7 Object Overlaying

It allows editing the way two or more objects are overlayed. The available options on the **Screen** toolbar are:

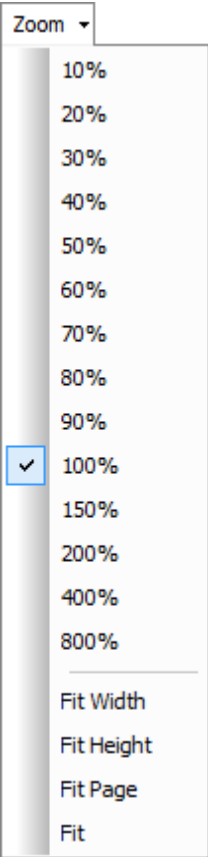
Available options on the Screen toolbar

ICON	OPTION	DESCRIPTION
	Bring to Front	The selected object is brought to the first position in the overlaying order (ALT + HOME).
	Send to Back	The selected object is sent to the last position in the overlaying order (ALT + END).

ICON	OPTION	DESCRIPTION
	Bring Forward	The selected object is brought forward one position in the overlaying order (ALT + PAGE UP).
	Send Backward	The selected object is sent backward one position in the overlaying order (ALT + PAGE DOWN).

7.3.8 Zoom

When editing a Screen, users can choose the most appropriate and comfortable zoom level for this operation. Zoom is available via **Zoom** contextual menu, with levels ranging from 10 to 800%, in addition to the **Fit Width**, **Fit Height**, **Fit Page**, and **Fit** options, according to the next figure.



Zoom menu

In addition to this **Zoom** menu, users can also change the zoom level via keyboard

or mouse, by using the following combinations:

- **CTRL + PLUS SIGN (+):** Zoom in
- **CTRL + MINUS SIGN (-):** Zoom out
- **CTRL + ASTERISK (*) or CTRL + ZERO (0):** Return to default zoom (100%)
- **CTRL + Mouse wheel up:** Zoom in
- **CTRL + Mouse wheel down:** Zoom out

NOTE: When using CTRL + Mouse wheel (up or down) options, zoom focus is always relative to the mouse pointer's position.

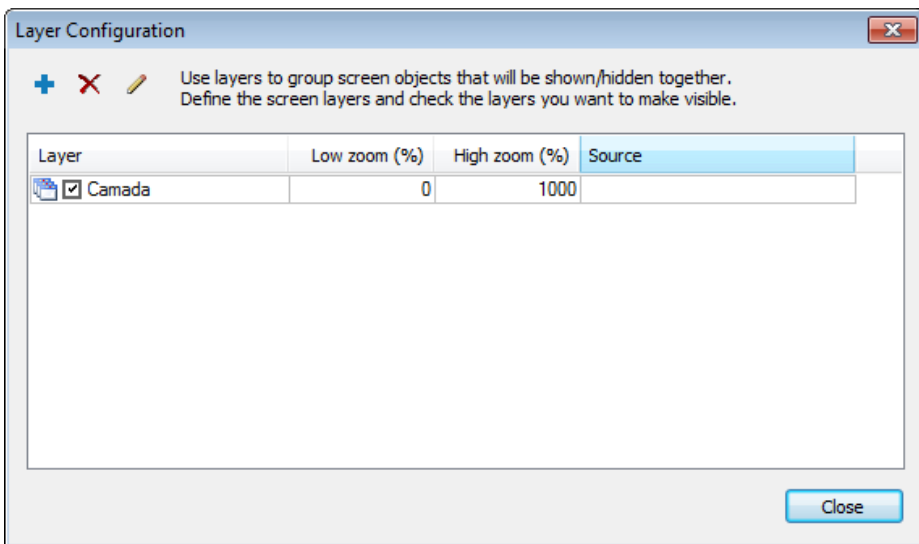
7.3.9 Layers

E3 offers a Screen architecture with up to 32 layers for inserting graphical objects. Each object can belong to one or more layers, and the active Screen both in configuration (E3 Studio) and at run time (E3 Viewer) may have none, one, several or all active layers. This allows the creation of applications with several forms of monitoring such as, for example, viewing a process only with the electrical system, only with the hydraulic system, or both. Users can also control the appearance of layers depending on a certain zoom level. The layer configuration is performed by clicking **Layers**. The available options are:






Available options for Layer configuration

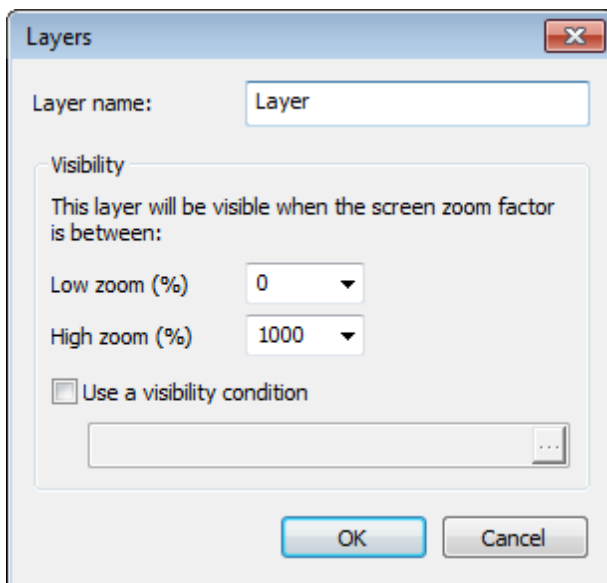
OPTION	DESCRIPTION
Layer	Enables viewing the layer configured in the Screen's Layer property.
All Layers	Shows all layers available in the project.
No Layers	No layer is shown.
Edit Layers	With this option, users can configure individual layers. This option opens a dialog box for configuring the layer.

When the **Edit Layers** option is selected, the following dialog box is shown.



Layer Configuration


The Layer Configuration window has the following options: **Add Layer** , to create a new layer; **Remove Layer** , to remove the selected layer; and **Edit Layer** , to edit the selected layer. By clicking  or , the following dialog box is opened:



Adding or editing layers

The available options are:

Available options for Layers

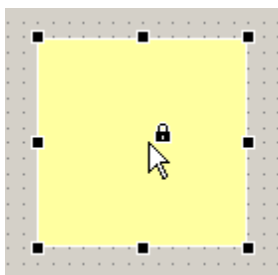
OPTION	DESCRIPTION
Layer name	Determines the layer's name.
Low Zoom	Determines the initial percentage of zoom on the layer.
High Zoom	Defines the final percentage of zoom on the layer.
Use a visibility condition	Enables the use of an additional zoom visibility condition. This condition can be a variable or any other property.
Source 	Establishes a Link or property that, once active (different from zero), also displays the layer (the Zoom and Source options are not exclusive, that is, the layer can be activated when either conditions are active).

For further information, see the **Scripts Reference Manual**.

7.3.10 Lock

When this option is selected, E3 Studio does not allow the object to be moved, avoiding unwanted movements. After locking an object, the mouse displays a pointer with a locker when moving over the object.

To enable this option, right-click the object and choose **Lock** .




Locked object

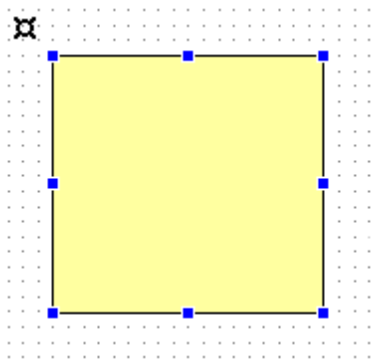
To disable this option, right-click the object again and choose **Unlock**.

7.3.11 Anchor Point

An **Anchor Point** defines the coordinates that mark the starting point of an object. The anchor point is initially linked to the object's coordinates.

To enable this option, right-click the object and select the **Define Anchor Point** option. The object then appears with an  icon next to it, from where it can be moved to any place on the Screen. When dragging the object with the new anchor,

the point that was defined will be fixed to the grid points, and the object will be displaced with the same proportions relative to the anchor. This is viewed only if the **Snap to Grid** (Grid properties) option is enabled.



Object with an anchor point

NOTE: When using the key combination CTRL + SPACEBAR (the *Snap to Pixel* effect) on an object with its **Define Anchor Point** option enabled, the object is then moved to the nearest pixel, disregarding the position of the anchor point. In case of moving an object using the mouse, then the anchor point is positioned right on a pixel. To correct any discrepancies in the object positioning, the key combination CTRL + SPACEBAR can be used right after releasing the mouse button.

7.3.12 Shadow

It allows applying or editing the shadow effect on a Screen object.





Shadow options

To use this resource, follow these procedures:

1. Insert or select the object to which the shadow will be applied.
2. Change its properties on the **Shadow** toolbar, according to the following options:

Available options for Shadow toolbar

OPTION	DESCRIPTION
	Enables or disables a shadow effect on the object.
	Moves the shadow under the object.
	Moves the shadow above the object.
	Moves the shadow to the left of the object.

OPTION	DESCRIPTION
	Moves the shadow to the right of the object.
	Configures object's shadow color.

7.3.13 Draw

It allows applying or editing color information for Screens and Screen objects, and border information for Screen objects.






Draw options




To use this resource, follow these procedures:

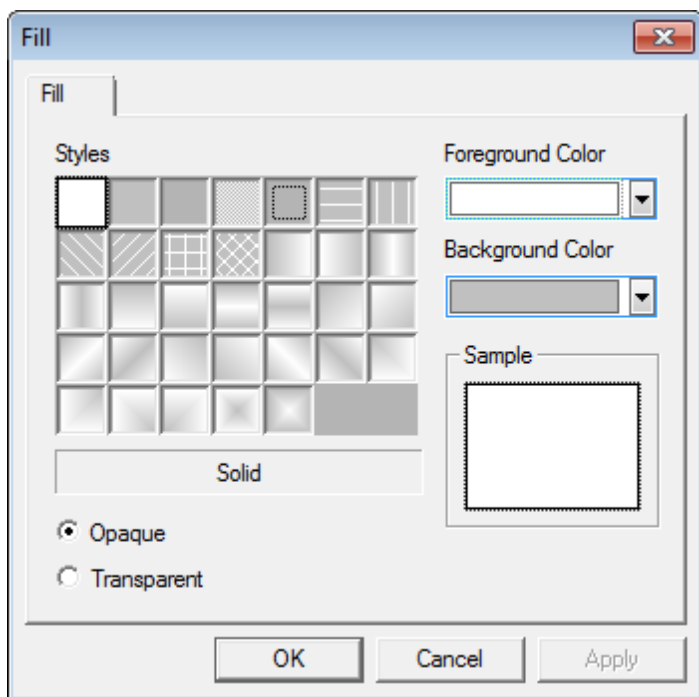
1. Insert or select the object (Screen or Screen object) whose colors or borders will be edited.
2. Change its properties according to the options available on **Draw** toolbar.

The available options on this toolbar are:

Available options for Draw toolbar

ICON	OPTION	DESCRIPTION
	Background Color	Allows selecting the Screen's or Screen object's background color from a list of pre-defined colors, or creating a new custom color.
	Foreground Color	Allows selecting the Screen's or Screen object's foreground color from a list of pre-defined colors, or creating a new custom color.
	Border Color	Allows selecting the Screen object's border color from a list of pre-defined colors, or creating a new custom color.



ICON	OPTION	DESCRIPTION
	Border Style	Allows choosing the type of border displayed by the Screen object from a list of pre-defined styles: a continuous line, different types of dotted and dashed lines, or simply no border at all.
	Border Thickness	Allows choosing the Screen object's border thickness from a list of pre-defined widths, ranging from 0 to 2.5 millimeters.
	Fill Style	Allows choosing the fill style displayed by the Screen or Screen object, that is, the type of combination between foreground and background colors. When selecting this option, the window displayed on the next figure is then opened.



Fill effects

The available options for this window are:

Available options for Fill window

OPTION	DESCRIPTION
Styles	Shows all possible fill styles available for the selected object.
Foreground color	Shows the previously selected foreground color. It also allows selecting a new color (same action as clicking ).
Background color	Shows the previously selected background color. It also allows selecting a new color (same action as clicking ).
Sample	Shows how the chosen effect will be applied to the object's background and foreground colors.

OPTION	DESCRIPTION
Opaque or Transparent	When selecting the Transparent option, the gradient styles with hatching effects will not display the object's background color, only its foreground color, thus creating a transparent effect in the object. By selecting the Opaque option, this effect does not happen. NOTE: The Transparent option is disabled for Screens.

7.3.14 Set Default Style

Sets the options configured on **Shadow** and **Draw** toolbars as the default for the other Screen objects that will be created. To use this resource, follow these procedures:


1. Select the object that will be the template for the others.
2. Right-click the object and select the **Set Default Style** option.
3. When creating a new Screen object, this object's Shadow and Draw configurations will be used as the initial configurations for the next objects.

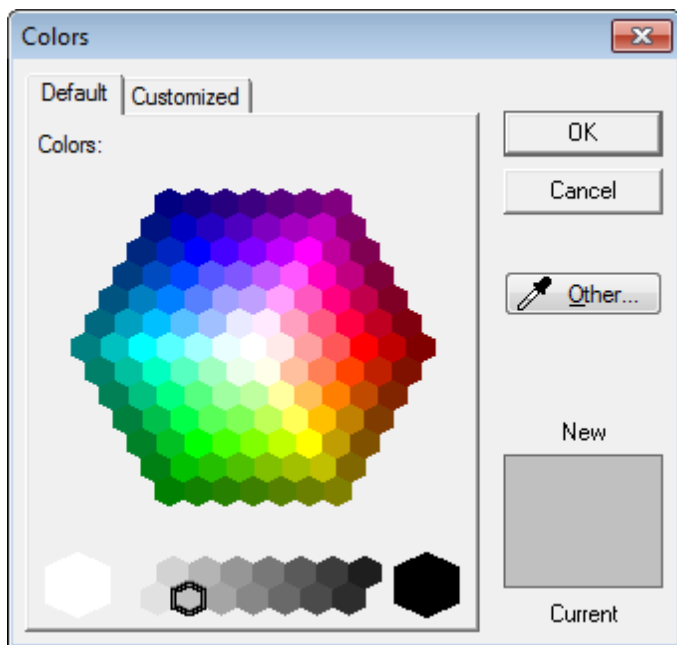
7.3.15 Apply Style

Applies the style configured as default in the **Set Default Style** option to previously created objects. To use this resource, follow these procedures:


1. Select the object to which the default style must be applied.
2. Right-click it and select the **Apply Style** option.

7.4 Color Formatting

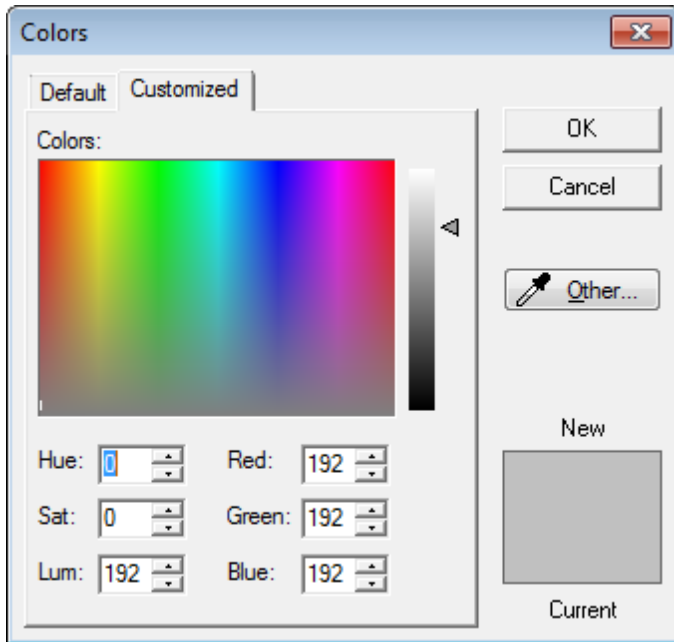
In **Color**-type properties, changing a value can be performed using dialog boxes, such as the one displayed next, available in the Properties window by clicking . There are two ways to select the intended color: via **Default** tab, where it is possible to select from pre-defined colors, or via **Customized** tab, where users can type color information by using its components.



Colors

The **Other** option allows users to select a color from anywhere on a Screen, inside or outside E3 Studio. Click  and then the intended color to capture it to the color window.

To customize a color, users can combine two different methodologies: **RGB** (red, green, and blue components), or **HSL** (hue, saturation, and lightness components).



Customized color

RGB scale describes a color by mixing three primary colors, as follows:

- **Red:** Indicates the amount of primary red component in color composition
- **Green:** Indicates the amount of primary green component in color composition
- **Blue:** Indicates the amount of primary blue component in color composition

Each one of these three color elements can have an intensity degree that ranges from 0 (zero) to 255.

HSL scale describes a color by mixing three primary components, as follows:

- **Hue:** Specifies a color distribution within the visible light spectrum
- **Saturation:** Indicates the intensity of a certain hue. A highly saturated hue has a more intense color, while a less saturated hue seems grayer
- **Lightness:** Indicates the amount of light applied to a color. The higher the luminance, the lighter the color. Conversely, the lower the luminance, the darker the color

These elements can also have their intensity degree ranging from 0 (zero) to 255. Thus, specify a value for each item, according to the color tone, or else select the desired color directly with the mouse pointer on window scales.

Numerical value for each color is obtained using the following formula:

```
Red * 256 ^ 0 + Green * 256 ^ 1 + Blue * 256 ^ 2
```

That is:

```
Red * 1 + Green * 256 + Blue * 65536
```

Consider that **Red**, **Green**, and **Blue** variables can assume values ranging from 0 (zero) to 255. For example:

- **Black (0, 0, 0):** $0 * 1 + 0 * 256 + 0 * 65536 = 0$
- **White (255, 255, 255):** $255 * 1 + 255 * 256 + 255 * 65536 = 16777215$
- **Red (255, 0, 0):** $255 * 1 + 0 * 256 + 0 * 65536 = 255$
- **Green (0, 255, 0):** $0 * 1 + 255 * 256 + 0 * 65536 = 65280$
- **Blue (0, 0, 255):** $0 * 1 + 0 * 256 + 255 * 65536 = 16711680$

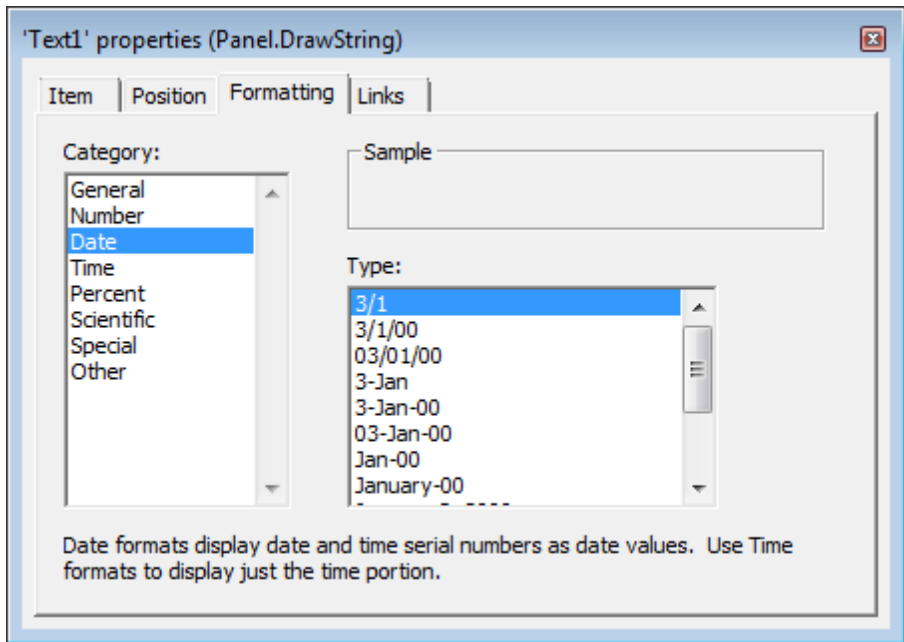
NOTE: Values stored on object properties referring to colors are numerical, calculated using the previously described formula. The **Find and Replace** tool uses this stored value on its search process, and not the value formatted as **RGB**, as displayed on Properties window.

7.5 Value Format

Using formatters allows users to change how data is displayed, without changing the value behind them. A format is a text that can be either edited manually or configured via format dialog box. Its usage is similar to the formatters used in spreadsheets, following the same basic syntax, but with a few extensions. The following data types are supported:

- Number (decimal, scientific, hexadecimal, binary, or octal outputs)
- Text
- Boolean
- Date and Time (Gregorian calendar)

The objects that support formats must change their data type in the **Value** property, according to the intended format type.



Value Format window

The following format categories are available:

- **General:** There is no specific format. It is performed automatically, depending on data type
- **Number:** Presents integers and fractions, allowing users to define the number of decimals and the use of commas to separate thousands. For numbers that are either too big or too small, use the **Scientific** format. The symbols are the ones defined at **Control Panel - Regional Configuration**
- **Date/Time:** Presents numerical values (Gregorian format) for date and time, when they are valid
- **Percent:** Multiplies the number by 100 and adds the percent symbol to it, also defining the number of decimals
- **Scientific:** This format presents a number with a mantissa and an exponent, ideal for numbers of different magnitudes, allowing users to choose the number of decimals and formats
- **Special:** Allows formatting integers in non-decimal bases (hexadecimal, octal, and binary)

7.5.1 Other Formats

In the **Other** option, users can create any type of format, even one from the previous section, by typing a format code (as text).

The text format is made of up to four fields separated by a semicolon. The first field is always applied when there is no other field more appropriated for that value or data type. The second field is used for negative numerical values. The third field is used whenever the numerical value is zero. The fourth field is used for **text**-type values.

Whenever defining more than one field, the previous field is considered, even if it is empty. In the event of an empty field format, the formatted value is always an empty text. Notice how this differs from the **General** format, which is just an empty format without field separators (semicolons).

To insert characters that is displayed by the format, users can place them between quotes or after a backslash. Examples (valid for all format types):

Text Input	
FORMAT	FORMATTED OUTPUT
"0#?"	0#?
\m\d\y	mdy

Users can also create formats that contain only text, which can be combined with the use of different fields, as in the next example:

Format and Formatted Output		
VALUE	FORMAT	FORMATTED OUTPUT
1	"Positive";"Negative";"Zero" ", "Text"	Positive
-1	"Positive";"Negative";"Zero" ", "Text"	Negative
0	"Positive";"Negative";"Zero" ", "Text"	Zero
"Abcd"	"Positive";"Negative";"Zero" ", "Text"	Text

Also, the following characters can be displayed directly without the need of quotation marks or slashes: \$ - + / () : ! ^ & ' (simple quote to the left) ' (simple quote to the right) ~ { } = < >

NOTE: To display a backslash or double quotation marks in the formatted data, use \" or \\. When the text is between quotation marks, the whole text is copied directly, so \"a\" is displayed simply as \a.

Numerical formats accept three basic types of characters to define the number of displayed digits:

Numerical Formats

OPTION	DESCRIPTION
0 (zero)	Inserts the significant digit, or 0 (zero) when there is none
#	Inserts the significant digit
?	Inserts the significant digit, or a blank space when there is none

The decimal separator defines how to display the fractional part of a number. The comma indicates that the value must be divided by a thousand (for each comma), after the format's digits.

Regardless of Windows Region and Language configurations, the dot and the comma must be used on the format's text, to indicate the thousands and decimal separators, but the formatted output complies with the system's regional configurations. Examples:

Available options

DATA	FORMAT	FORMATTED OUTPUT
12000	#,	12
1234567	#,#.0	1,234,567.0

7.5.1.1 Scientific Formats

A number can be presented in scientific notation (mantissa and exponent) when after any digit there is an **E+**, **E-**, **e-**, or **e+**, followed by digits to format the exponent. When using **E+** or **e+**, the exponent is displayed with a sign, and when using **E-** or **e-**, the sign appears only for negative exponents, and the exponent always displays a digit, even if it is 0 (zero). The number of digits right to the decimal place affects the displayed exponent. Examples:

Scientific formatter

DATA	FORMAT	FORMATTED OUTPUT
1000	#E+00	1E+03
1000	##e-00	10e02

7.5.1.2 Text Formats

The **@** character copies data values on the position where it appears. This format must appear in the fourth field (for example, **;;;@**) or directly when there is only one field. Examples:

Text formatter

DATA	FORMAT	FORMATTED OUTPUT
Abc	@@	Abc Abc
xyZ	"Name: " \ " @ \ "	Name: "xyZ"

7.5.1.3 Non-Decimal Base Formats

Formats for non-decimal bases always present the whole part of the formatted numerical value, and they are also not sensitive to signs. As in decimal bases, if the number has more digits than required in this format, these digits are presented anyway.

Currently, these formats are limited to 32-bit numbers. In case the value's whole part exceeds this limit, this format returns an error. Examples:

Formatters for Non-Decimal Bases

DATA	FORMAT	FORMATTED OUTPUT
255	"0x"XXX	0x0FF
12345	oooo\o	30071o
987	B	1111011011
12	BBBB - BBBB	0000 - 1100

7.5.1.4 Date and Time Formats

Date and Time format syntax differs a little from spreadsheets, following the mode used by Windows region and language configurations. Dates are numerical values where the integer part represents days since December 31st 1899 and the fraction represent hours in day fractions.

The minimum year supported is 100 and the maximum is 9999. This guarantees a resolution of at least 1 ms in the whole interval. Names of months and week days, default day, month, and year sort order, and the date and time separators are all used according to Windows region and language configurations. On the next table, users can check the format and its formatted output for values.

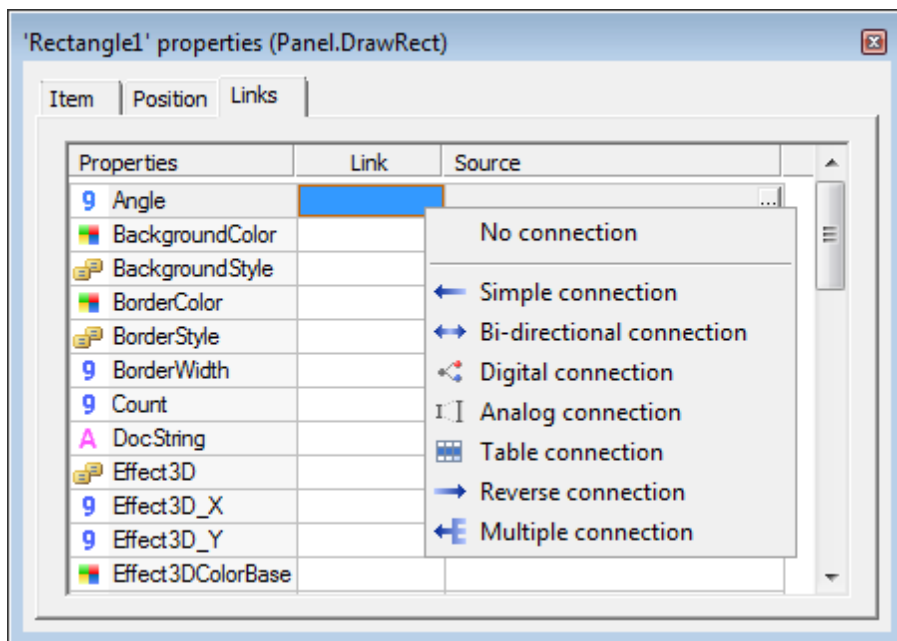
Formatters for Date and Time

DATA	FORMAT	FORMATTED OUTPUT
1234.56789	dd/MMMM/yyyy	18/may/1903
0.56789	hh:mm:ss.000 tt	01:37:45.696 PM
12.345678	hh\hmm\mss.000\s	296h17m46.667s

NOTE: Values stored in object properties referring to dates are numerical values, calculated using the previous formula. The **Find and Replace** tool uses that stored value on the search process, and not the formatted date and time values displayed on Properties window.

Links are connections performed among properties and objects, or among properties. Links make easier to create animations and other types of common logic, thus minimizing the usage of scripts.

Users can open the **Links** tab by right-clicking the object, and then selecting **Properties**. This tab displays all object properties that can be connected, as well as the existing Link types and their sources.




Links tab

The available options on **Links** tab are described on the next table.

Available options for Links tab

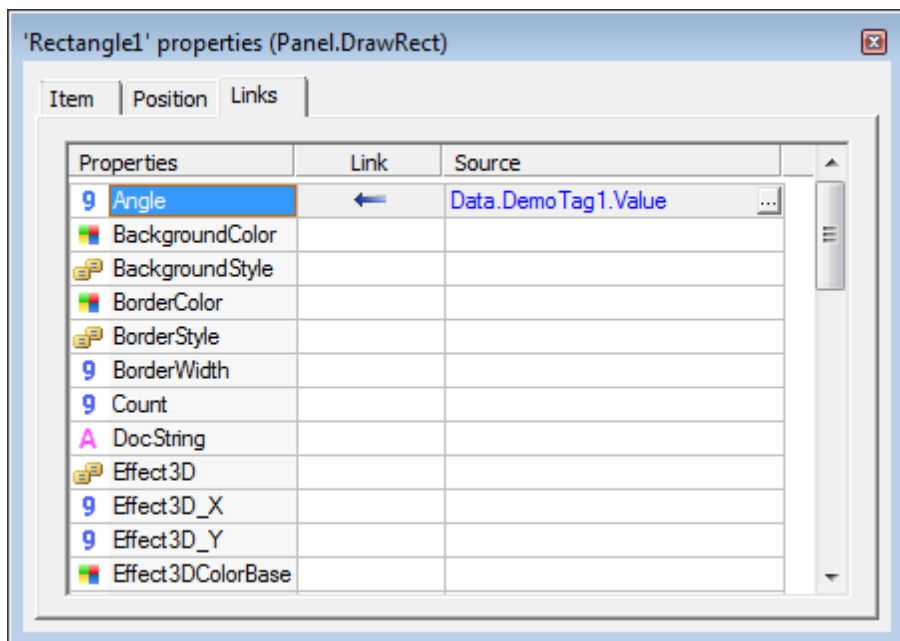
OPTION	DESCRIPTION
Properties	Lists object properties that can be linked.

OPTION	DESCRIPTION
Link	Determines the Link type of the selected property. For common properties, the available Links are: Simple, Bi-directional, Analog, Digital, Table, Reverse, and Multiple . There is also a link among ElipseX properties and objects, which still cannot be modified (for more details, please check the chapter Libraries).
Source	In the simplest case, specifies the path to an object or property. This path can be filled in by using AppBrowser, which can be opened by clicking  , on the right side of this field. In general, this is an expression allowing logical and arithmetical operations, as well as evaluating functions for properties, objects, and constants.

By specifying the source of a Link, its text appears in blue, in case it corresponds to a valid expression. If this expression contains errors, as in non-existing object paths (or as in objects belonging to projects not loaded), its text appears in red. In these cases, the **Verify Domain** option informs the places that need corrections or revision. The available types of Links are explained on the next topics.


8.1 Simple

In a **Simple Link**, the value in the **Source** field is copied to the property each time the first one is modified.



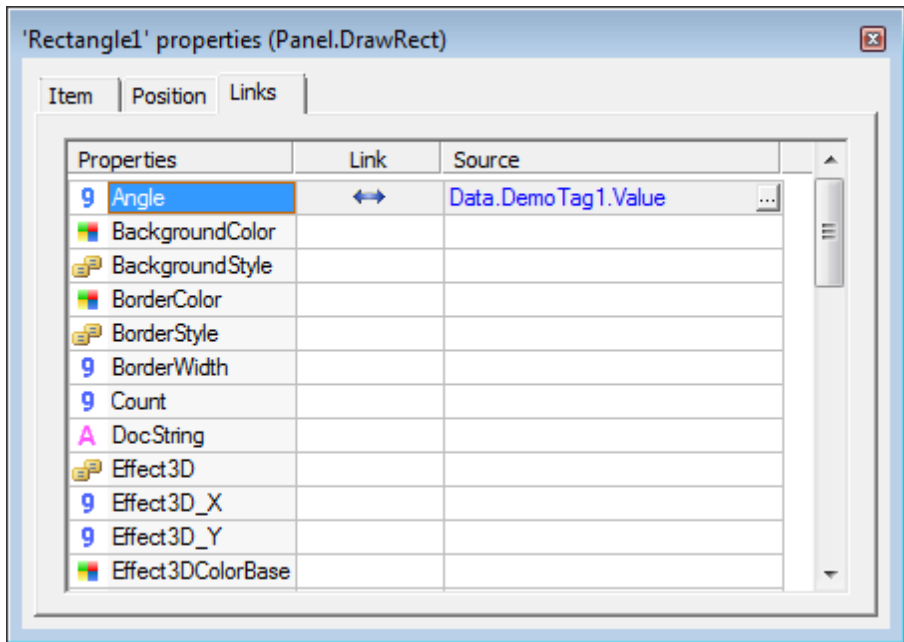
Simple Link

To use this resource, follow these procedures:

1. Select the object for the Link.
2. Right-click this object and select the **Properties** option.
3. Click the **Links** tab and select the property to perform the Link. Studio indicates several types of Links.
4. In the **Source** field, select the Link and click  to indicate the property to refer, or write down an expression in this field.


8.2 Bi-directional

A **Bi-directional Link** is similar to a Simple Link. However, if there is a variation in this property, its value is copied to the source, thus generating a bi-directional Link.



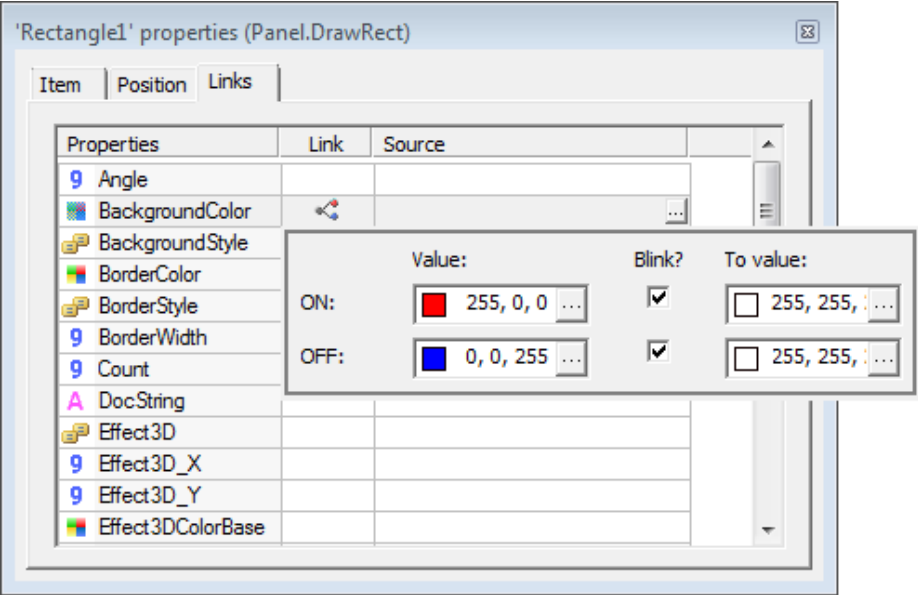
Bi-directional Link

To use this resource, follow these procedures:

1. Select the object for the Link.
2. Right-click this object and select the **Properties** option.
3. Click the **Links** tab and select the property to perform the Link. Studio indicates several types of Links.
4. In the **Source** field, select the Link and click  to indicate the property to refer, or write down an expression in this field.

8.3 Digital

With a **Digital Link**, users can establish that, if a variable or expression in the **Source** field represents a digital value (**Boolean**), its True or False status is mapped to certain values on the destination, including the **Blink** option (alternating values).




Digital Link

The available options for this Link are described on the next table.

Available options for a Digital Link

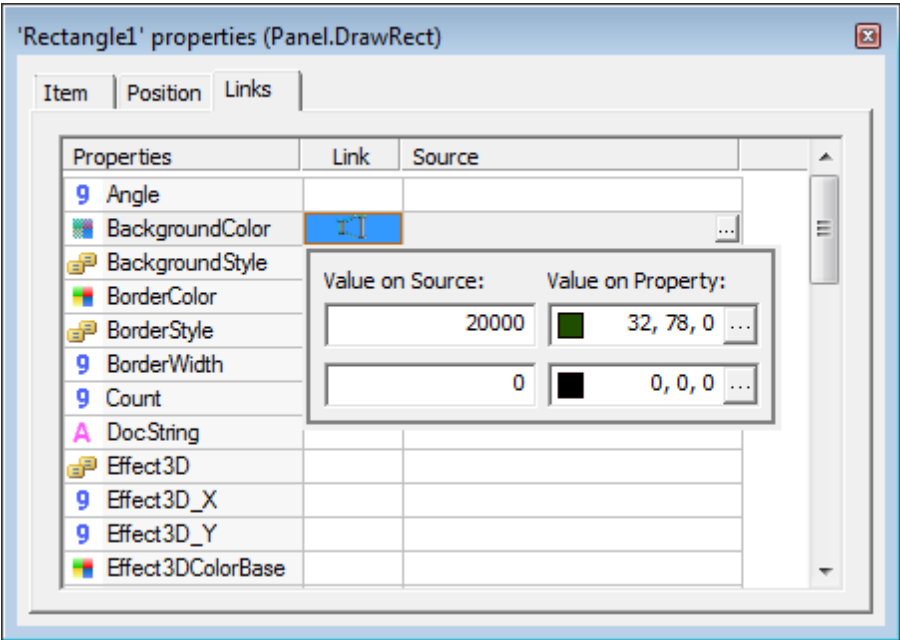
OPTION	DESCRIPTION
ON	Specifies the value assumed by this property when the source expression is True.
OFF	Specifies the value assumed by this property when the source expression is False.
Blink	When this field is enabled, the linked property alternates between the values in the To Value field, if the source returns True. Otherwise, the returned property alternates between the values in the Value and To Value fields, if the source returns False.
To Value <Field On>	Specifies an alternative value to be assumed periodically by this property when the source expression or Link results in True and the Blink field is enabled.
To Value <Field Off>	Specifies an alternative value to be assumed periodically by this property when the source expression or Link results in False and the Blink field is disabled.

To use this resource, follow these procedures:

1. Select the object for the Link.
2. Right-click this object and select the **Properties** option.
3. Click the **Links** tab and select the property to perform the Link. Studio indicates several types of Links.
4. In the **Source** field, select the Link and click  to indicate the property to refer, or write down an expression in this field.

8.4 Analog

An **Analog Link** allows users to establish a conversion scale between the source and the destination variable. By using these specified values, a linear scale is performed between property and source values.



Analog Link


The available options for this Link are described on the next table.

Available options for an Analog Link

OPTION	DESCRIPTION
Value on Source	Determines maximum and minimum values reached on source.

OPTION	DESCRIPTION
Value on Property	Determines maximum and minimum values reached on property.

To use this resource, follow these procedures:

1. Select the object for the Link.
2. Right-click this object and select the **Properties** option.
3. Click the **Links** tab and select the property to perform the Link. Studio indicates several types of Links.
4. In the **Source** field, select the Link and click  to indicate the property to refer, or write down an expression in this field.

8.5 Table

With a **Table Link**, users can establish a set of intervals based on the minimum and maximum source values and, for each one of these values, a value to be assumed by a property. In addition, as in a Digital Link, users can specify a **Blink** option and an alternative value. To use this resource, follow these procedures:

1. Open the object's properties window and select the **Links** tab.
2. Select the property to create a Link and click the **Table Connection** item.

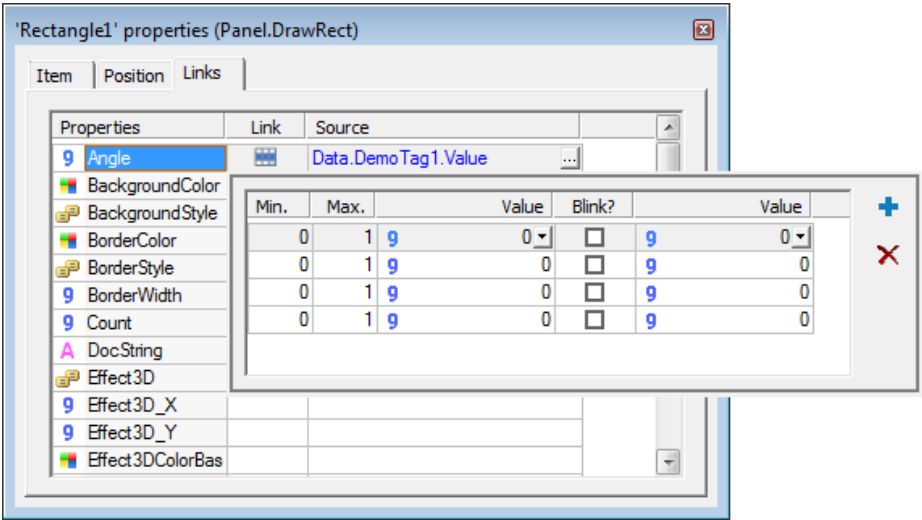




Table Link

The available options for this Link are described on the next table.

Available options for a Table Link

OPTION	DESCRIPTION
	Inserts a new row on the table.
	Removes the selected row from the table.
Min	Specifies the minimum value on the source for a table row.
Max	Specifies the maximum value on the source for a table row.
Value	Specifies the value on the property to be assumed when the source is inside the interval specified on the table row.
Blink	Determines that when the source is inside the interval for this table row, the property then alternates periodically between the values specified by the Value and Value <Blink Enabled> fields.
Value < Blink Enabled>	Specifies the alternative value of the property to be assumed when the source is inside the interval specified on table row, that is, when the Blink field is enabled.

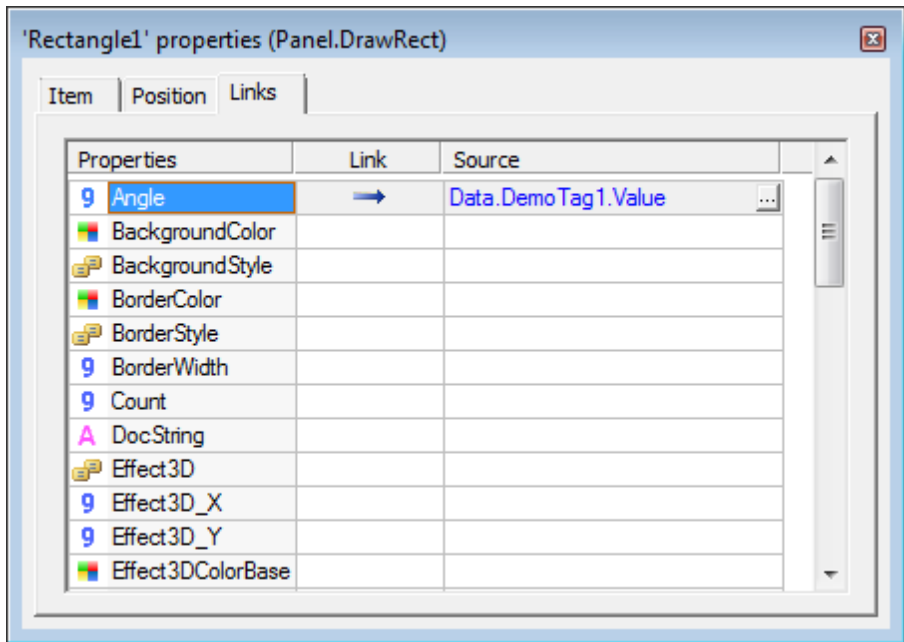
To use this resource, follow these procedures:

1. On the **Links** tab, select the property and link it to the **Table Connection** option.
2. Create the rows on the table and configure the **Min**, **Max**, and **Value** fields.
3. To alternate periodically between values, enable the **Blink** field and then configure the other options.

8.6 Reverse

With a **Reverse Link**, every time a property's value is modified, this value is copied to the source, thus working inversely to a Simple Link. To use this resource, follow these procedures:

1. Open the object's properties window and select the **Links** tab.
2. Select the property to create a Link and click the **Reverse Connection** item.



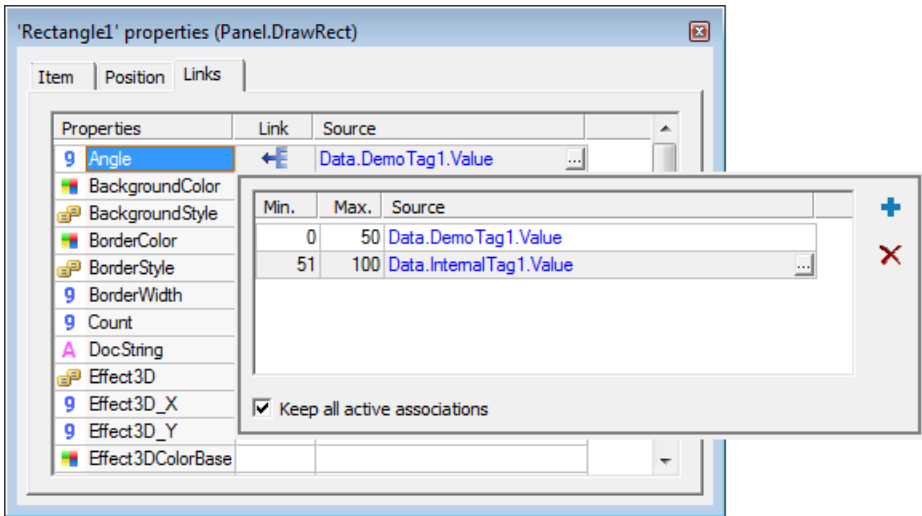
Reverse Link

8.7 Multiple

In a **Multiple Link**, each Link row allows retrieving its value from a different source. The active source is selected according to the Link's main source value.

Each row has an interval (the **Min** and **Max** properties) and the source for that interval (the **Source** property, which is a normal link). To use this resource, follow these procedures:

1. Open the object's properties window and select the **Links** tab.
2. Select the property to create a Link and click the **Multiple Connection** item.
3. Define the Link's main source on the **Source** column.



Multiple Link

The available options for this Link are described on the next table.

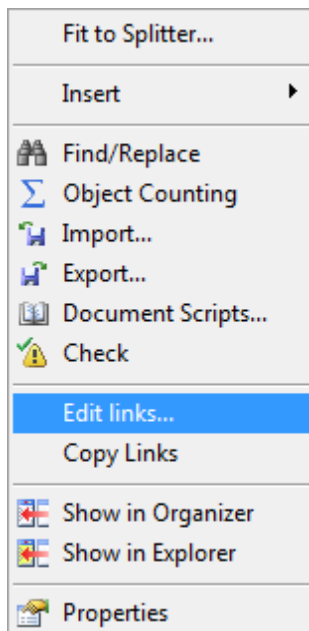
Available options for a Multiple Link

OPTION	DESCRIPTION
	Inserts a new row on the table.
	Removes the selected row from the table.
Min	Specifies the minimum value on the source for a table row.
Max	Specifies the maximum value on the source for a table row.
Source	Specifies the source to be linked to the property when the value of the main source is between Min and Max limits.
Keep all active associations	Keeps all table Links in Advise (active) mode. This property corresponds to the AdviseAll property.

8.8 Link Edition

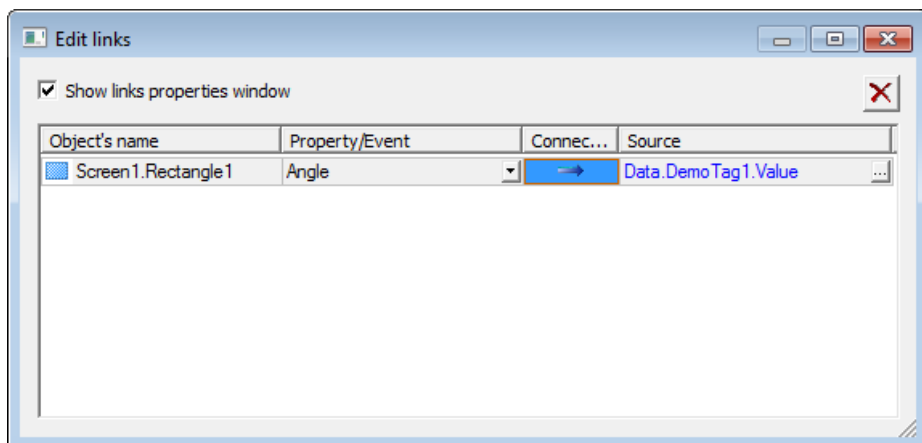
E3 has a tool to edit Links, named **Edit Links**. With it, users can edit one or more application Links more quickly than using a traditional window.

To use this tool, right-click one or more objects and select the **Edit links** option.



Edit Links option

The dialog box on the next figure is then displayed.



Edit Links

The previous dialog box shows a list of Links, **Link**-type properties, and user events related to the selected objects and their child objects. According to a row type, information to display on columns are described on the next table.

Available options for Edit Links window

OPTION	DESCRIPTION
Object's name	Determines object's name.

OPTION	DESCRIPTION
Property / Event	Determines the object's property that contains this Link.
Connection	Determines a Link type (Simple , Bi-directional , Digital , Analog , Table , Reverse , and Multiple).
Source	Determines a Link's source.

Options for Link-type properties


OPTION	DESCRIPTION
Object's name	Determines the name of the object that contains this property.
Property / Event	Determines property's name.
Connection	It is always the same (Link).
Source	Determines property's value.

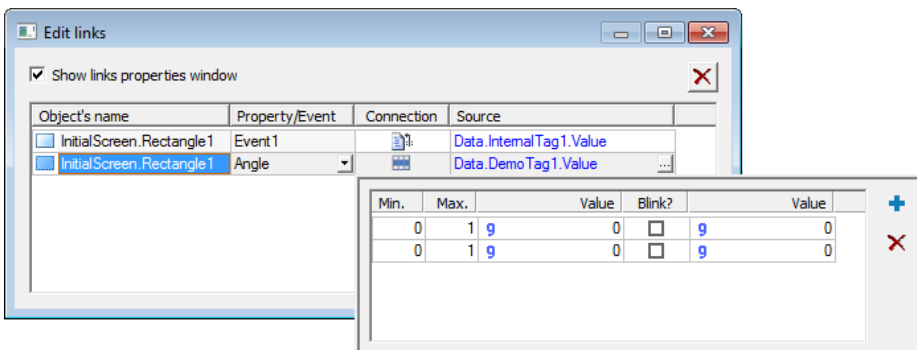
Options for User events

OPTION	DESCRIPTION
Object's name	Determines the name of the object that contains this event.
Property / Event	Determines the name of a user event.
Connection	Determines an event type (OnEvent , WhileEvent , or OnValueChangeEvent).
Source	Expression related to this event.

On the **Edit Links** dialog box, users can modify the following options:

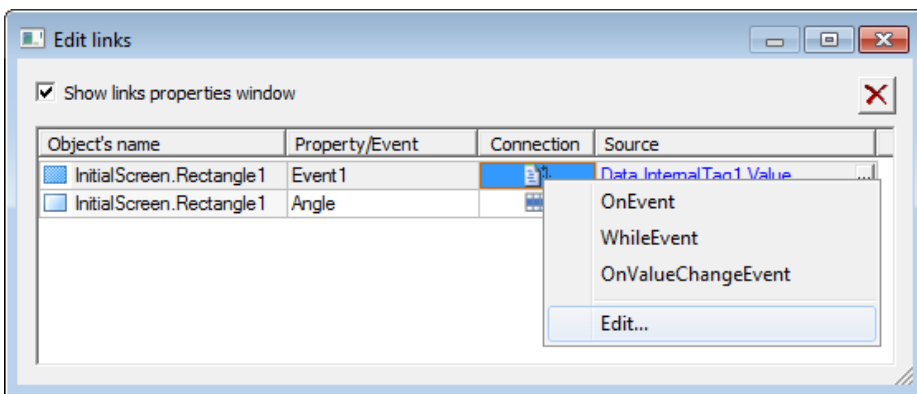
- **Links:** Can be modified, except for object's name
- **Link-type properties:** Can be modified, except for object's name
- **User events:** Can be modified, except for object's name and event's name

By clicking , users can remove the selected Link. The **Show links properties window** option determines whether Link minidiags are displayed when a row is selected. If this window is visible, then users can edit Link properties. Its default value is enabled.



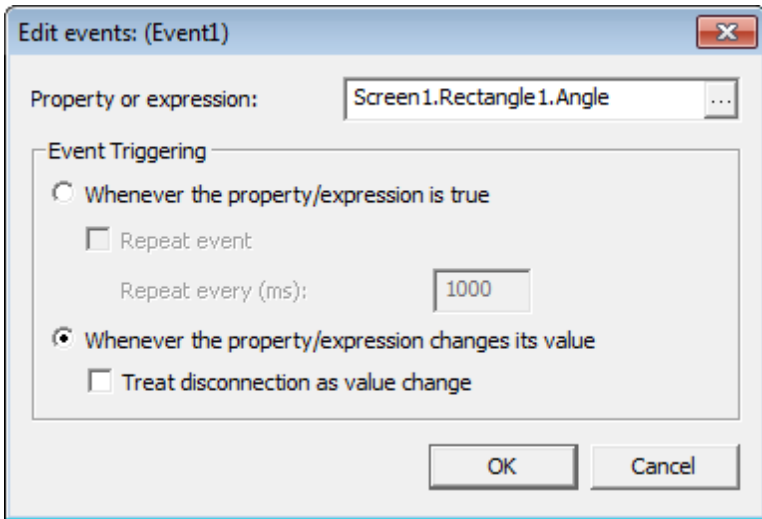
Editing properties of the selected Link

To edit user event properties, it is necessary to select a row containing the event and, on **Connection** column, click the **Edit** option.



Editing user event properties

When clicking the **Edit** option, the dialog box on the next figure is displayed, thus allowing to edit the selected user event.



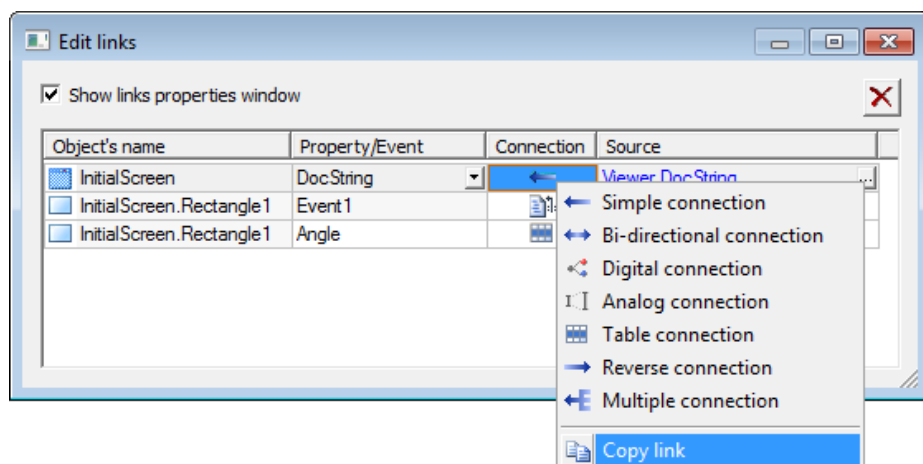
Edit events window

The available options on this window are described on the next table.

Available options for Edit Events window

OPTION	DESCRIPTION
Property or expression	Property or expression generating this event.
Whenever the property/expression is true	Indicates whether this is an etOnEvent - or an etWhileEvent -type.
Repeat event	Indicates the cycle for event repetition in milliseconds, that is, its periodicity while an expression generating it remains true.
Repeat every (ms)	Value for a repetition interval, in milliseconds.
Whenever the property/expression changes its value	Indicates that this event is an etOnValueChangeEvent -type, that is, this event occurs whenever the expression that generates it changes its value.
Treat disconnection as value change	If there is a disconnection, it is handled as a value change.

The Edit Links window allows using copy and paste features among property Links. The **Copy Link** option copies a Link from the selected row and the **Paste Link** option pastes that Link to the selected row, replacing the previous Link.

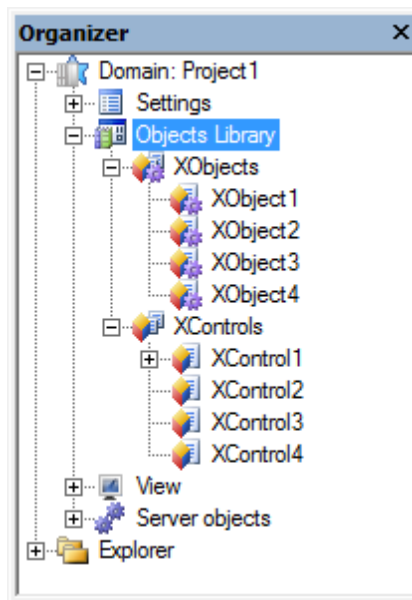


Option to copy or paste a Link

E3 has tools that allow transforming any object or set of objects of an application into a user library. **Libraries** can be composed of frequently used objects, and subsequently reused in another application.


E3 provides two types of user libraries: the **Gallery**, a library of vector graphical symbols, which can be freely used in the applications, and a user library tool called **EclipseX**. The use of libraries in E3 is highly recommended most of the time, due to the productivity gains they bring to the applications. Some advantages of EclipseX:

- Reusing source code
- Reducing tests during development
- Creating default interfaces for developed objects
- Reducing development time of new projects
- Protecting project's content




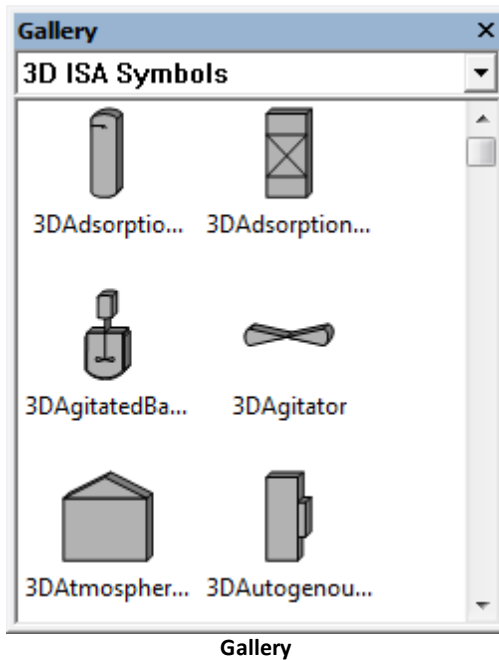
Libraries in Organizer

9.1 Gallery

The **Gallery** can be accessed by clicking  on **Default** toolbar. In this item there are a series of vector graphical elements, divided into categories, which can be dragged to Screens or to ElipseXs. The available types of symbols are: 3D Pushbuttons, 3D ISA Symbols, Air Conditioning, Architecture, Arrows, ASHRAE (Controls and Equipment), ASHRAE (Ducts), ASHRAE (Pipes), Basic Shapes, Blowers and Fans, Boilers, Buildings, Chemical Processes, Computer Hardware, Computer Keys, Containers, Controllers, Conveyor belts and Production Lines, Ducts, Electrical System, Flexible Tubes, Finishing, Food, Outflow Meters, General Symbols, Heating, HVAC, Icons and Bitmaps, Industrial Miscellany, International Symbols, ISA Symbols, Laboratory, Machinery, Maps and Flags, Material Handling, Mining, Pipes, Pulp & Paper, Mixers, Engines, Nature, Human-Machine Interfaces, Panels, Industrial Accessories, Power Devices, Processes Cooling, Processes Warming, Pumps, Security, Scales, Segmented Pipes, Sensors, Cuts in Tanks, Textures, Valves, Vehicles, Water and Water Supply, Wires, and Cables.

To use this feature, follow these procedures:

1. Click  **Gallery** on **Default** toolbar.
2. By selecting this tab, users have access to sets of symbols grouped in categories. Select the category from the upper part of the window.
3. To insert an object from the symbol library on a Screen, simply click the desired object and drag it to the Screen.
4. After inserted, the object can be freely edited and modified, according to the features described for image objects, such as for example, change the filling color using the **OverrideFillMode**, **OverrideFillColor**, or **OverrideLineColor** properties, with no need to transform the object into an E3 graphical object.



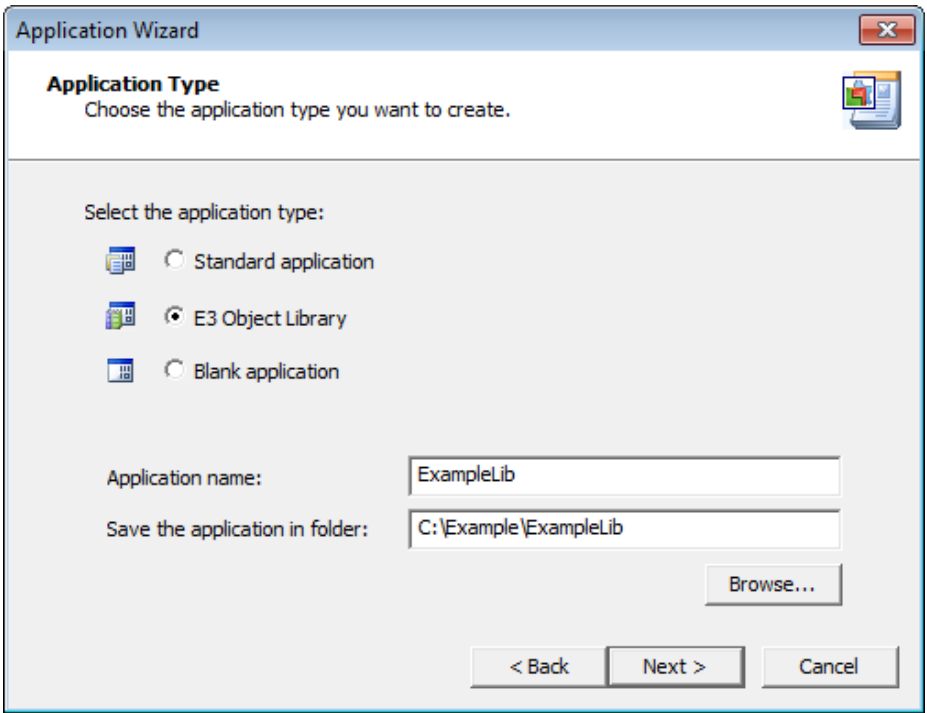
9.2 User Library (ElipseX)

An **ElipseX** is an E3's object library. In addition to drawings, an ElipseX may contain internal variables that can be exported to an application, besides programming logic (scripts) that is available in all object's copies, diminishing the need to repeat code in several parts of an application.

ElipseXs are encapsulated in a .lib file. Users can create all ElipseXs to use in a specific project in the same Library file (.lib) or divide them among several files, as desired.

To create a new library in E3, follow the next procedures:

1. Select the **New Project** menu and then click **Next**.
2. In the **Type of Application** option, select the **E3 Object Library** option.



Creating a user library (ElipseX)

3. Specify the name of the library and click **Next**.
4. Set the specifications referring to the Domain.
5. Click **Finish**.

Within an ElipseX library, two types of objects can be inserted: Graphical XControl objects and XObject data objects.

The following items can be inserted in XControls: Drawing Primitives (Straight lines, Rectangles, Circles, etc.), Vector Graphical Objects, including objects from the symbol library (WMF, EMF, etc.), Non-Vector Graphical Objects (BMP, JPEG, GIF, etc.), E3's ActiveX Controls (E3Chart, E3Browser, E3Alarm, ActiveX Controls from third-parties) and other XControls.

On the other hand, XObjects can contain any type of non-graphical objects that are executed in an E3 Server, such as I/O Drivers, Data Servers, Databases, Formulas, Alarm Configurations, Alarm Servers, and COM Objects, among others.

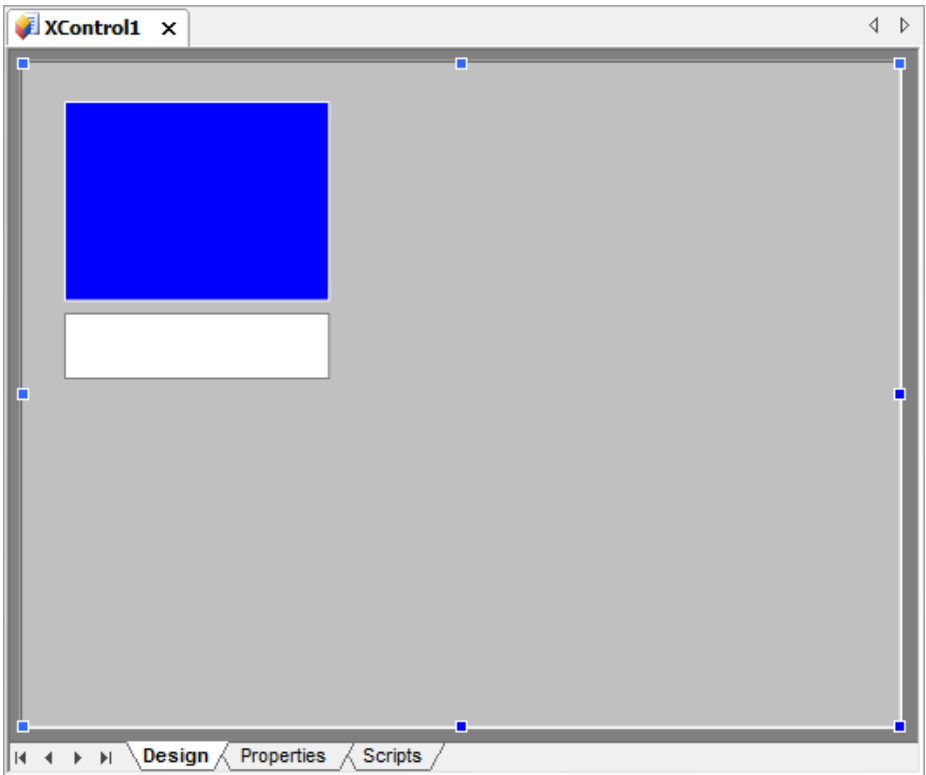
Within the same .lib file there may be any number of ElipseX components, either XControls or XObjects. Users can also have several different libraries within the same Domain.

Notice that for each XObject or XControl created in a library two interfaces are

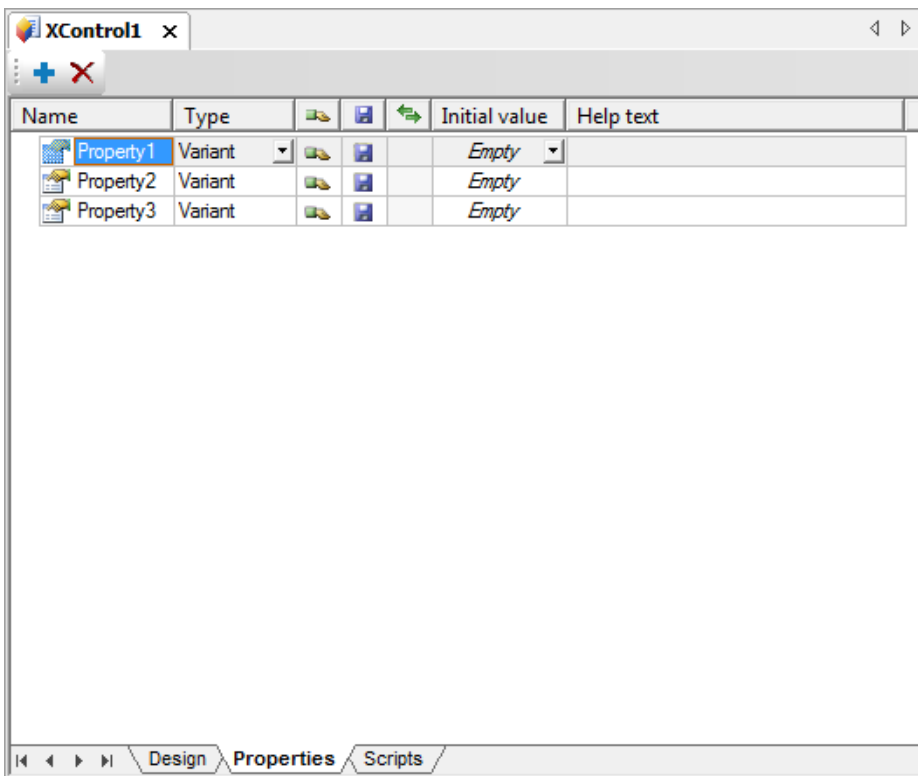
internally created, one to declare the object's properties, and another one to declare object's events. These interfaces have their names generated automatically, adding a "D" prefix to that name (the event interface adds the "Events" suffix to this automatic name). If, for example, an object's name is "XObject1", its property's interface is called "DXObject1" and its event's interface is called "DXObject1Events". Any attempt to use these names in other classes in the same library generates an error code **8002802D**, which corresponds to **Name already exists in the library**.

9.2.1 XControls

An **XControl** defines a graphical interface to the user, which can be composed of any E3 object, and its purpose is to be easily multiplied by the project. Users can create an XControl right-clicking the LIB file created in the Domain, then selecting the **Insert - XControl** option.



Design tab of an XControl






Properties tab of an XControl

When inserting an XControl, this object view is opened, composed by three tabs. Besides the **Scripts** tab, which is common to all objects, there is the **Design** tab, which is equivalent to a Screen, where graphical objects previously described can be inserted, and the **Properties** tab, where variables can be inserted, which are XControl properties. These properties are exported by the object and can be linked to a Tag or to another property when the object is used in the application.

The variables to be exported can be inserted by pressing the INSERT key in the keyboard or by clicking **+**, and can be excluded by pressing the DELETE key or by clicking **-**. The available options of this item are described on the next table.

Available options for Properties tab

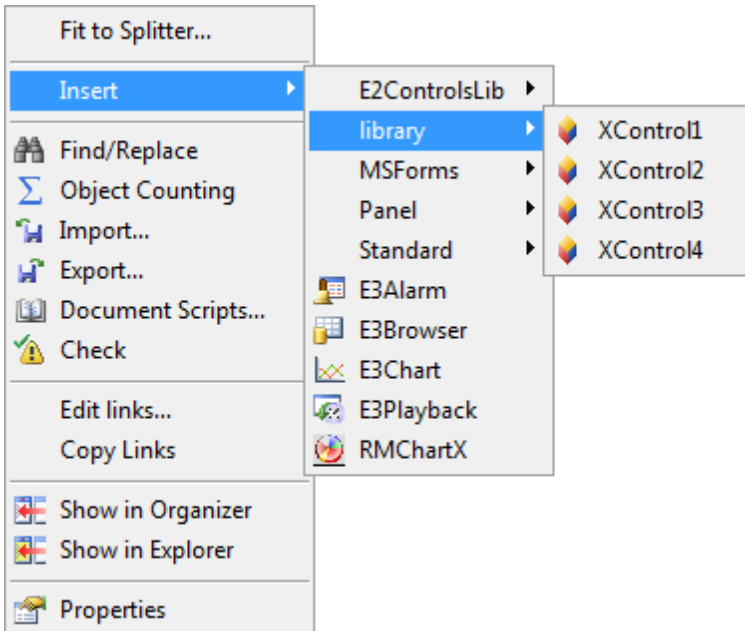
OPTION	DESCRIPTION
Name	Specifies the XControl's variable name.

OPTION	DESCRIPTION
Type	<p>Determines the data type supported by the variable. Notice that other data objects (XObjects) may be declared as Types. This way, users can create a data object that has another data object as a property. Data objects may work as a struct or as a class in this case, as in the C/C++ language. When specifying an object type (for example, DemoTag, IOTag, XObject, etc.), this property has the following behavior:</p> <ul style="list-style-type: none"> • If the ElipseX is inactive: This property works as a String, which specifies the path of the object instance of the configured type • If the ElipseX is active: On writing, this property works the same way as the previous case. However, on reading this property returns the specified object, in case it exists. If the path does not point to an existing object at the time, this property returns Nothing
	Enables or disables the visibility of the variable outside the library, that is, determines whether the variable is public or not.
	Determines whether the variable is saved in the project or not.
	Determines whether this property is retentive or not. Regarding XControls, properties cannot be retentive.
Value	Specifies the initial value of the variable.
Help text	Variable declaration and documentation text.

NOTE: Notice that Data Objects (XObjects) can be declared as Types.

Graphical object edition can be performed in the same way when editing a Screen, with the same graphical features and options.

Users can insert XControls on any Screen, or even within another XControl by right-clicking the destination Screen or XControl, and then selecting the **Insert** option, as shown on the next figure. From an XControl in development (inside the library), it is possible to insert another XControl in it, by right-clicking the destination XControl, and then selecting the **Insert** option.



Inserting an XControl on a Screen

From this moment on, the XControl has a name within the Screen and is understood as a copy of the original definition. Thus, users must define (if required) the values or Links this specific copy has in the context it is used. If this object's size is altered on the Library's Design view and registered again, it is necessary to go to Screen's **Original Size** contextual menu for this change to appear.

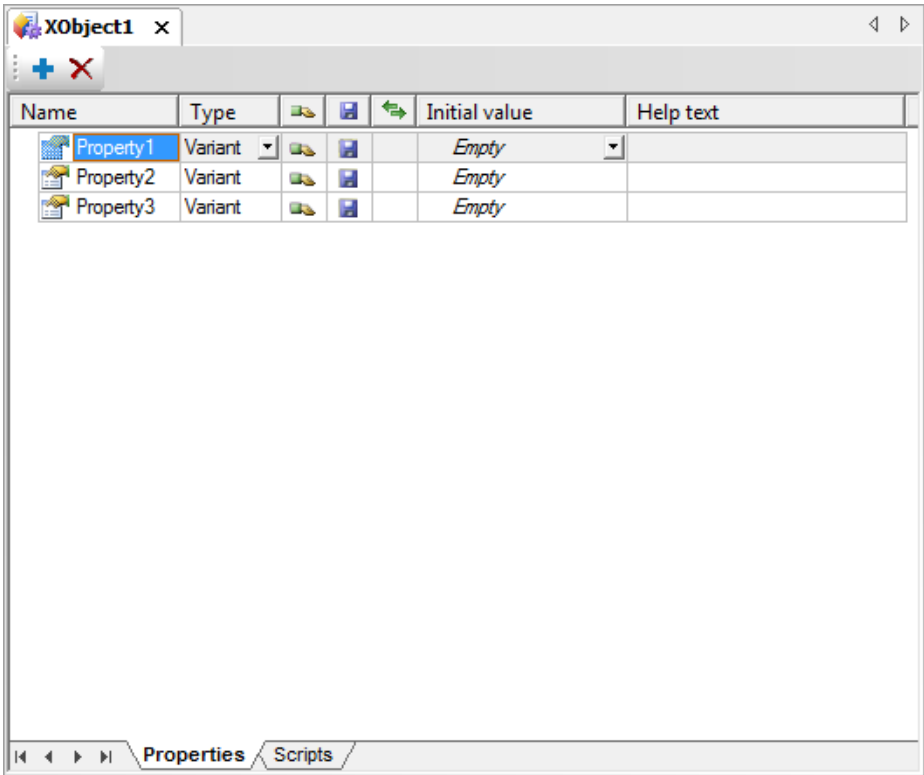
If an object named **Pump** was created, for example, which has a property named **Status**, which receives an external information disclosing whether this pump is turned on or off, thus changing its color. When inserting this object on a Screen, E3 automatically renames this object to **Pump1**.

Users can keep this name or rename it to another one. Then, users must inform which variable is linked to the **Status** property. Suppose that a certain I/O Tag represents the status of this pump. Therefore, a Link between the **Status** property and the referred Tag must be created. The same procedure must be performed for other instances (copies) of the Pump object required in the project.

9.2.2 XObjects

In addition to XControls graphical objects, users can create a data library called **XObject**. With it, users can define a data structure, which is executed in the server. Such structure can perform calculations, links, communications, alarm acknowledgments, historical recordings, etc., regardless of a graphical interface (Viewer) opened or in execution at that moment. To create an XObject, right-click the **Objects Library - XObjects** item in **Domain** mode, select the **Insert XObject in**

option, and then the name of the library.






XObjects


When inserting an XObject, the view of this object is opened, where variables can be inserted. These variables are properties to be exported by the object, which can be linked to a Tag or any other property of an application when the object is in use in an application.

The variables with properties to be exported can be inserted by pressing the INSERT key on the keyboard or by clicking **+**, and excluded by pressing the DELETE key or by clicking **-**. The available options of this item are described on the next table.

Available options for XObjects' view

OPTION	DESCRIPTION
Name	Specifies the XControl's variable name.

OPTION	DESCRIPTION
Type	<p>Determines the data type supported by the variable. Notice that other data objects (XObjects) may be declared as Types. This way, users can create a data object that has another data object as a property. Data objects may work as a struct or as a class in this case, as in the C/C++ language.</p> <p>When specifying an object type (for example, DemoTag, IOTag, XObject, etc.), this property has the following behavior:</p> <ul style="list-style-type: none"> • In case the ElipseX is inactive: This property works as a String, which specifies the path of the object instance of the configured type • In case the ElipseX is active: On writing, this property works the same way as the previous case. However, on reading this property returns the specified object, if it exists. If the path does not point to an existing object at the time, this property returns Nothing
	Enables or disables the visibility of the variable outside the library, that is, determines whether the variable is public or not.
	Determines whether the variable is saved in the project or not.
	Determines whether this property is retentive or not.
Value	Specifies the initial value of the variable.
Help text	Variable declaration and documentation text.

Only properties with simple types (**Variant**, **String**, **Date**, **Double**, etc.) can be retentive (the view automatically deselects the  column if the property type changes to an object type), and only XObject properties can be retentive.

NOTE: Using retentive properties in ElipseXs may increase the starting time of an application, and also increase memory consumed by E3Run process. These times vary depending on the number of XObject instances, number of retentive properties on each XObject, and the amount of these properties that have its value changed (if the property never changes, its retentive value remains zeroed).

In an XObject can be inserted any E3 modules executed on the server, as for example:

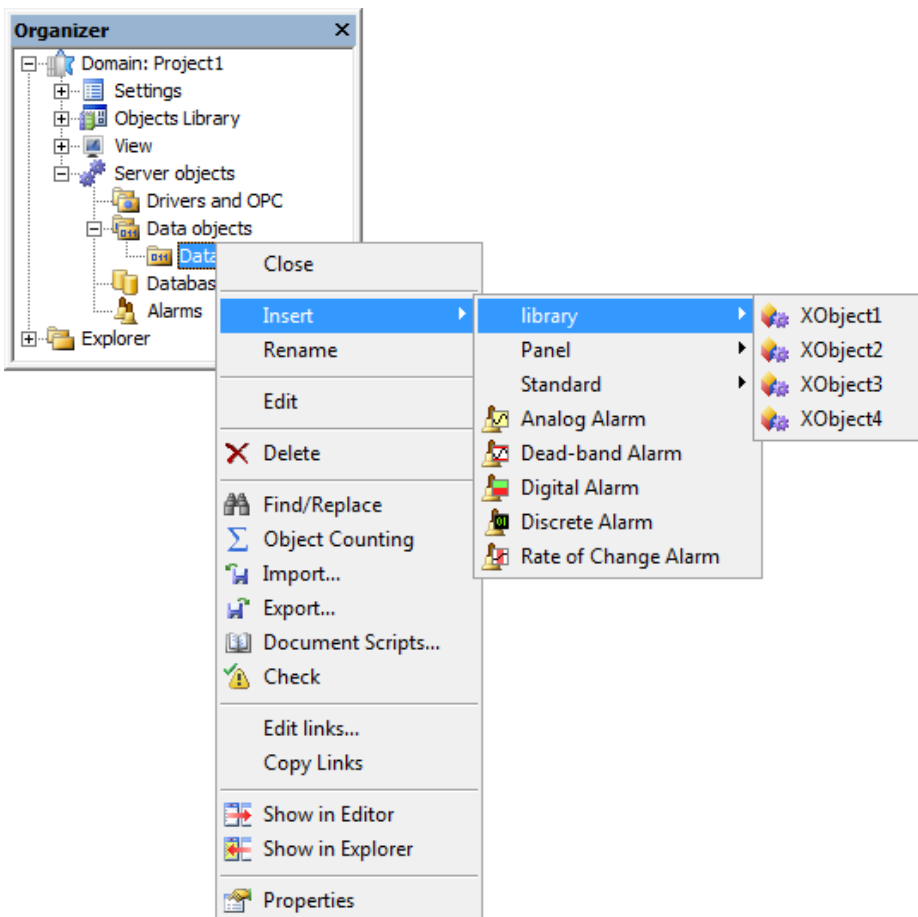
- I/O Driver and OPC Driver

- Alarms Server and alarms
- Database Server
- Formulas
- Data Server
- Historic objects

This allows users to define as a library a complex management system that can be easily replicated, as many times as it is required in an application.

IMPORTANT: Notice that as the XControl or the XObject could only communicate with the external world using properties (or even through mouse and keyboard, in case of XControls). This means that users cannot access XObject' or XControl's internal data, except within the object itself.

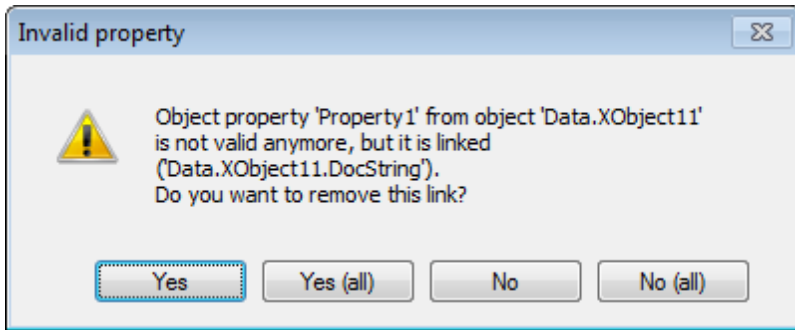
Users can insert XObjects in any Data Server, by right-clicking the Data Server in **Domain** mode, selecting the **Insert** option and then the name of the XObject, as shown on the next figure. In **Explorer** mode, right-click the project's Data Server, select the **Insert** option and then the name of the XObject.



Inserting an XObject in Domain mode

Notice that even if the library files have several XControls and XObjects, when trying to insert an instance (copy), E3 Studio will show for the Screens only the XControls, and for the Data Servers, only the available XObjects.

NOTE: Users must be careful to not delete an XControl or XObject property that have a Link. These properties, once deleted, do not appear in object's properties list anymore, and therefore they cannot be edited. When the **Check Domain** operation is executed, a search for these properties is performed and the user is asked whether to remove this Link or not.



Invalid property

Users can select not removing, and then recreate the erased object with the property to edit, remove only the property currently displayed, remove all properties, or not removing any property.

9.3 When to Create an ElipseX

Using libraries is highly recommended due to the productivity gain they bring. Some advantages of ElipseXs are:

- Reusing source code
- Reducing tests during development
- Creating default interfaces for developed objects
- Reducing development time for new projects
- Protecting project's content

Thus, using libraries is recommended for most applications. However, there are some criteria to indicate the need to build objects in E3:

- **Repetition of use:** If the same device or process is used more than once in the same project
- **User knowledgeable procedures:** Often, a process created by a specific company must be protected against copies or changes. This is common in case of service integrators or machine manufacturers
- **Use of controllers:** A process controller, whose memory mapping is fixed, can be implemented with all available functionality. The available flexibility for building and using objects in E3 allows that only variables of interest be used later, ignoring the other ones

NOTE: For examples on how to create ElipseXs, and for further information on these objects, please check the **Scripts Reference Manual**.

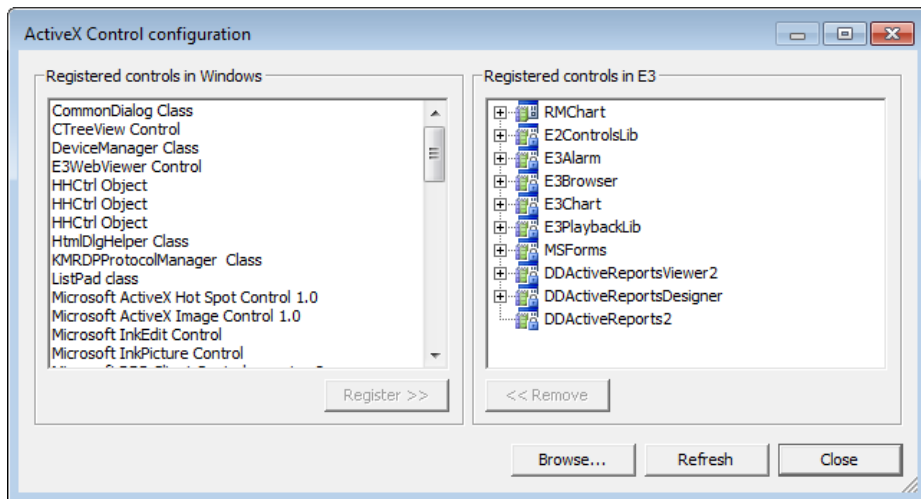
ActiveX objects are COM-based (*Component Object Model*) software components that can be inserted into an application to perform several tasks. These objects are developed in programming languages such as C/C++, Delphi, and Visual Basic, among others.

Some ActiveX objects are automatically registered when E3 is installed: E3Alarm, E3Browser, and E3Chart (developed by Elipse Software); Microsoft Forms (developed by Microsoft); and Report (ActiveReports, developed by Data Dynamics). **E3Alarm**, **E3Browser**, **E3Chart**, and **Report** objects have specific chapters further in this Manual. **Microsoft Forms** objects are described in another topic on this chapter.

NOTE: For ActiveX objects not previously installed by E3, these objects must be installed in all computers where an application is executed, specially on Remote Viewers.



In addition to these ones, users can insert any ActiveX object. To register an ActiveX in E3, follow these procedures:

1. Open the **Tools - Manage Active X** menu. The following dialog box is then displayed.

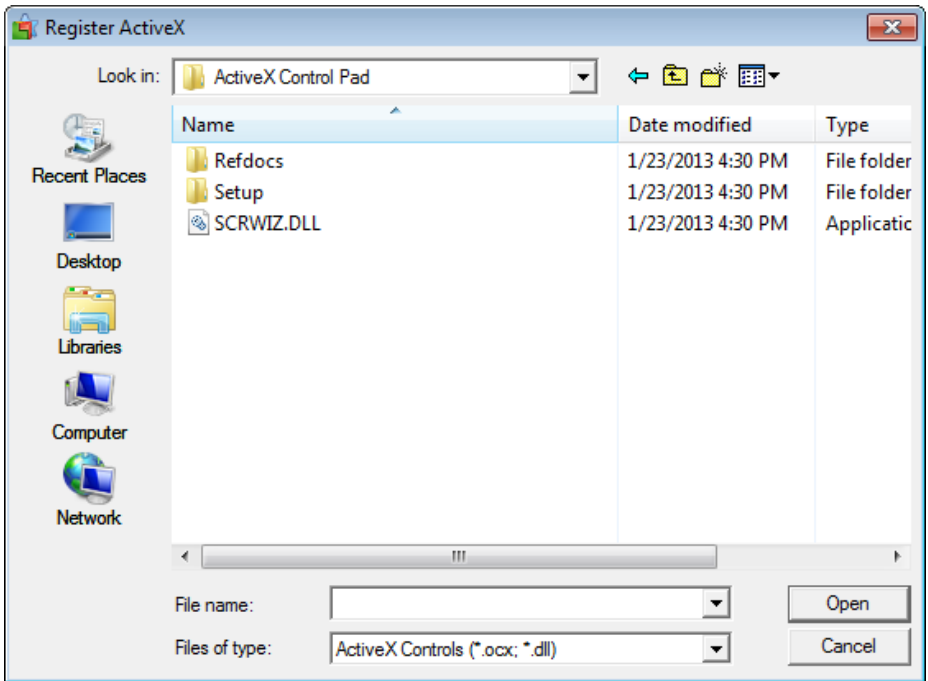


ActiveX Control configuration window

Available options for ActiveX Control configuration window

OPTION	DESCRIPTION
Registered controls in Windows	List with all ActiveX controls registered in Windows and that can be added to E3.
Registered controls in E3	List with all ActiveX controls already registered in E3.
Register	Registers the selected control in E3. If this control is not compatible with E3, a dialog box is then displayed warning users about this incompatibility.
Remove	Removes the selected control from the Registered controls in E3 list, moving it back to the Registered controls in Windows list. Controls with an  icon cannot be removed, only the ones with an  icon.
Browse	Opens a dialog box to search for an ActiveX file.
Refresh	Allows updating ActiveX controls on the Registered controls in Windows list, which were registered after opening this configuration window.
Close	Closes the ActiveX Control configuration window.

- Click **Browse** to open a dialog box and locate a file that contains an ActiveX.



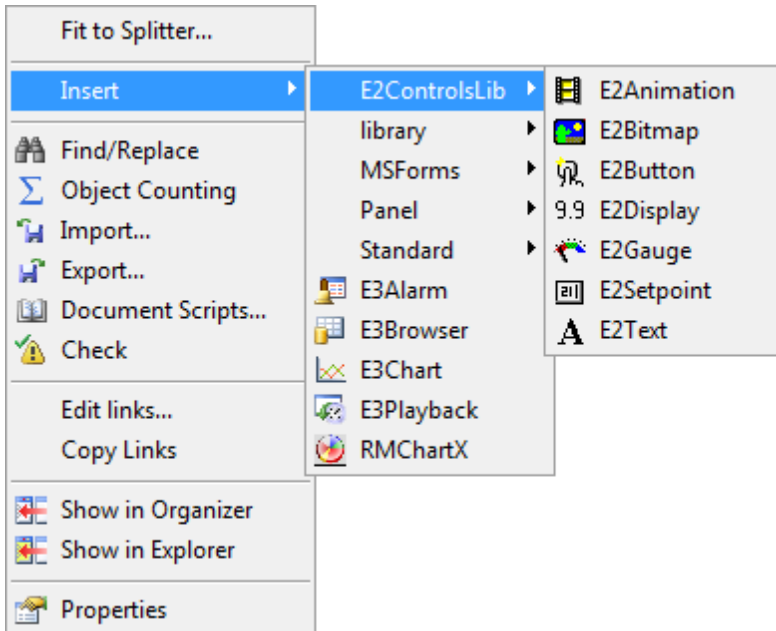
Locating an ActiveX file

3. Select the file and then click **Open**.

There are two types of ActiveX objects: **Graphical** (used in application Screens) and **Non-Graphical** (perform any data manipulation).

Graphical objects can be inserted on an application in three different ways:

- By selecting the appropriate object on **Objects** toolbar
- By right-clicking a Screen object in Organizer and then selecting the **Insert** option
- By right-clicking a Screen and selecting the **Insert** option



Inserting a graphical object on a Screen

Non-graphical objects can be used on applications via scripts, and they are created with VBScript's **CreateObject** standard method.

10.1 Microsoft Forms

To insert one of the Microsoft Forms previously registered in E3 on an application, there are two options:


1. Right-click the Screen and select the **Insert - MSForms** option.
2. Select the intended object on **Objects** toolbar; then, click the Screen to establish the object's initial point and drag the mouse diagonally until the object reaches the desired size and position.

The objects from Microsoft Forms library that are available in E3 are described in the next sections.


10.1.1 Check Box

Indicates whether an option is selected or not, or even if it is partially selected. It allows multiple selections inside a group. It is inserted on a Screen by selecting the ☒ icon.


10.1.2 Option Button

Indicates whether an option is selected or not. Unlike the Check Box, though, only one of these objects can be selected at a time; in E3, this control must be performed manually, via scripts that set the remaining Option Button's **Value** properties as 0 (zero) when one of them is clicked. It is inserted on a Screen by selecting the  icon.


10.1.3 Combo Box

Combines the functionality of a List Box and a Text box: with this object, users can either type the value directly, or select an item from a pre-established list. It is inserted on a Screen by selecting the  icon.


10.1.4 Command Button

Used to execute specific actions when pressed, such as opening a window, printing a report, etc. It is inserted on a Screen by selecting the  icon.


10.1.5 Label

Displays text messages that cannot be edited by the user, such as control descriptions or captions. It is inserted on a Screen by selecting the  icon.


10.1.6 List Box

Displays a list of items that users can choose one or more items. It is inserted on a Screen by selecting the  icon.


10.1.7 Scroll Bar

Facilitates navigation through a long list of items, or a big amount of information either horizontally or vertically. It is inserted on a Screen by selecting the  icon.


10.1.8 Spin Button

Used to increment or decrement values by using a pair of arrows. It is inserted on a Screen by selecting the  icon.

10.1.9 Text Editor

Enables users to insert and edit texts. It is inserted on a Screen by selecting the  icon.

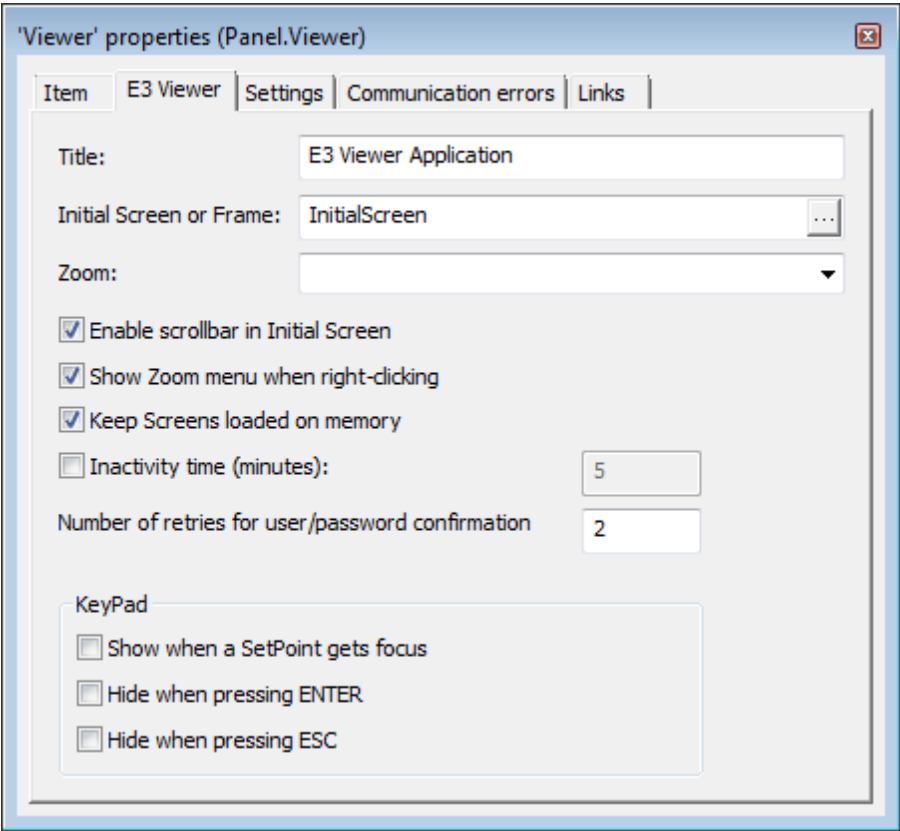
10.1.10 Toggle Button

Allows users to set one of two states to another Screen object. It is inserted on a Screen by selecting the  icon.

10.2 Elipse KeyPad

Elipse KeyPad is an ActiveX control developed by Elipse Software that allows using a virtual-floating keyboard in applications developed with E3.

This control can be activated on Viewer by using Viewer's **E3 Viewer** tab.



Viewer's E3 Viewer tab

The available options on this tab are described on the next table.

Available options for Elipse KeyPad on E3 Viewer tab

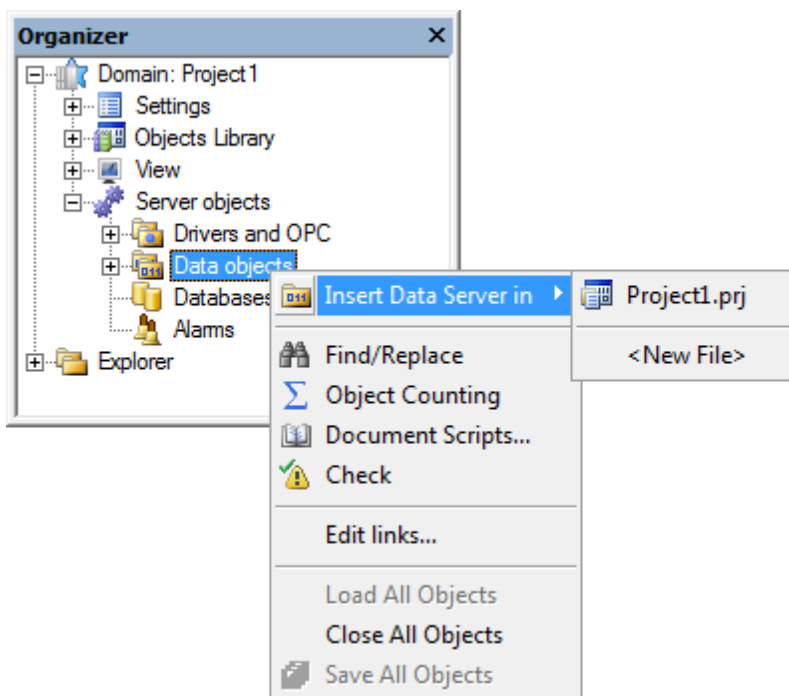
OPTION	DESCRIPTION
Show when a SetPoint gets focus	This options always shows Elipse KeyPad when a SetPoint object receives focus.

OPTION	DESCRIPTION
Hide when pressing ENTER	Enables hiding Elipse KeyPad when pressing the ENTER key. This option is equivalent to control's AutoHideOnEnter property.
Hide when pressing ESC	Enables hiding Elipse KeyPad when pressing the ESC key. This option is equivalent to control's AutoHideOnEsc property.

In scripts, KeyPad can be opened when using Application's **GetKeyPad** method. For more information on the functionality of this object's properties, please check the **Scripts Reference Manual**.

Data Servers are objects responsible for executing system variables, such as Internal, Demo and Timer Tags, as well as XObject instances. To use this feature, follow this procedure:

1. Right-click the project in Organizer and then select the **Insert Data Server in** option.



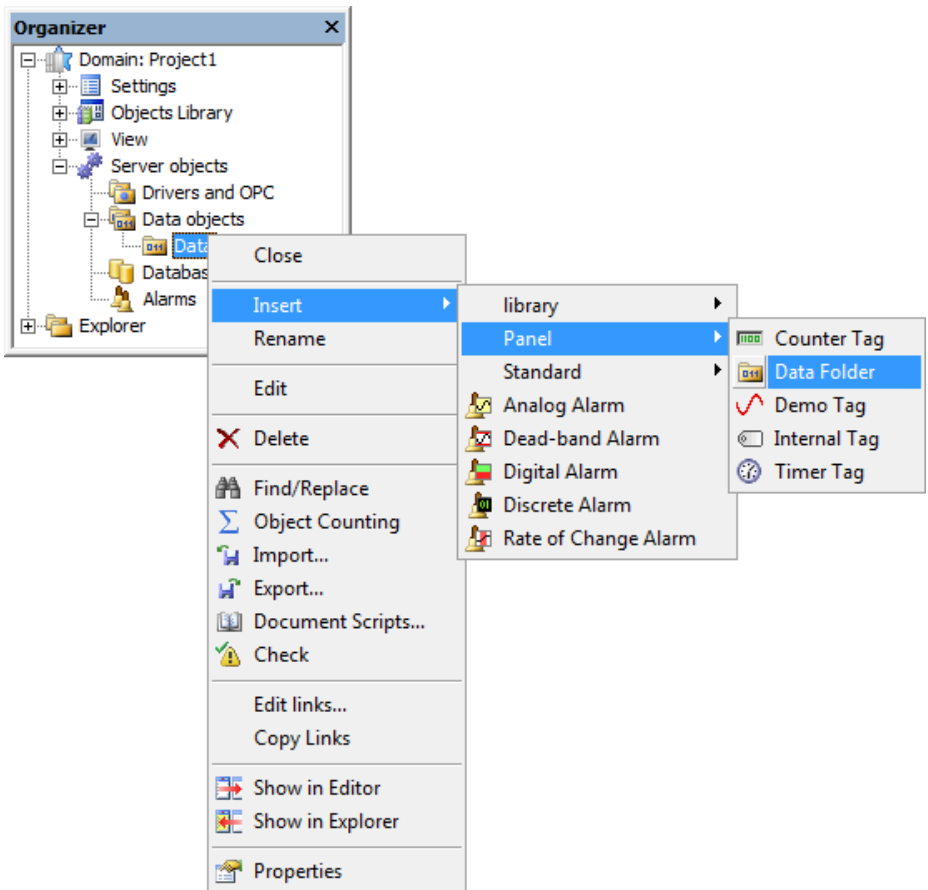
Inserting a Data Server

NOTE: Data Server objects (Data Folder, Counter Tag, Demo Tag, Internal Tag, and Timer Tag) can be configured to work as **Alarm Areas**.

11.1 Data Folder

A **Data Folder** defines groups to organize variables. If necessary, new Folders can be inserted into one another. To use this resource, follow this procedure:

1. Right-click a Data Server and select the **Insert - Panel - Data Folder** option.

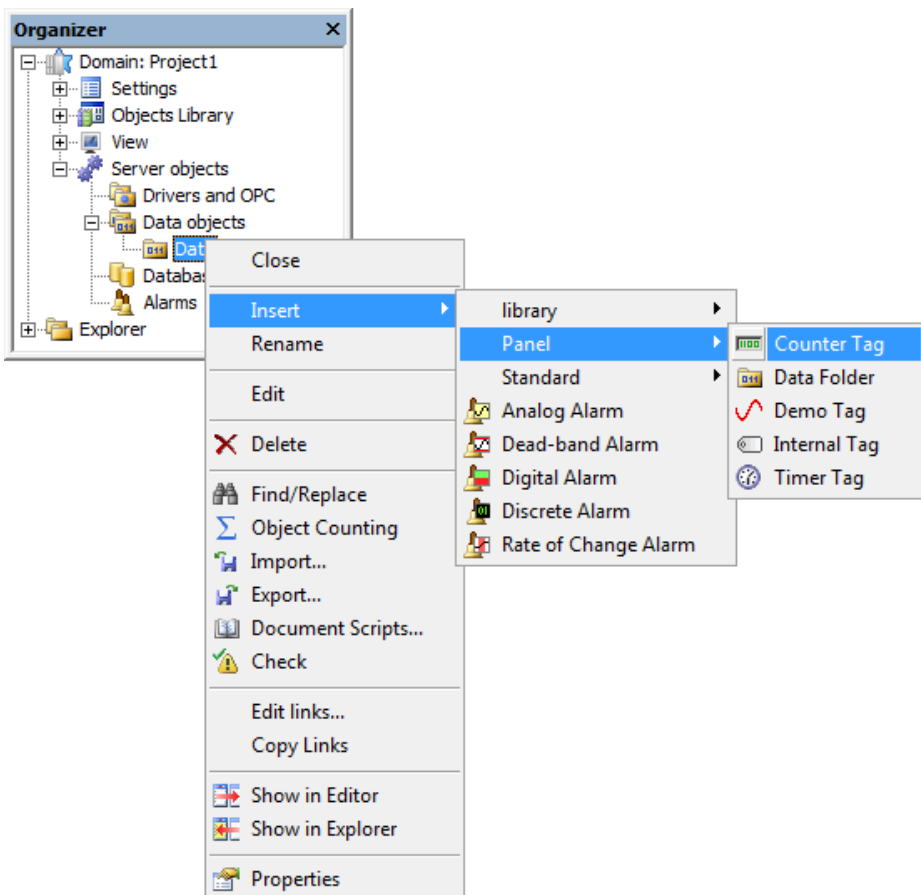


Inserting a Data Folder

11.2 Counter Tag

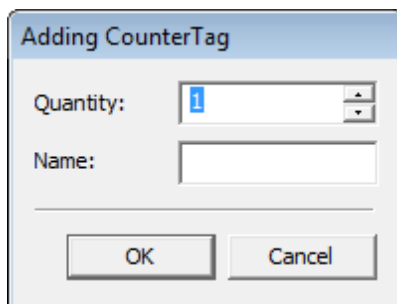
A **Counter Tag** is an object that counts time (in seconds) up to a pre-determined value, or even indefinitely. To use this resource, follow this procedure:

1. Right-click a Data Server and select the **Insert - Panel - Counter Tag** option.



Inserting a Counter Tag

- The system opens up a window asking the number of Tags to create in the Server, as well as their names. This name will be auto-incremented; if this option remains blank, Tags will be created with a default name.



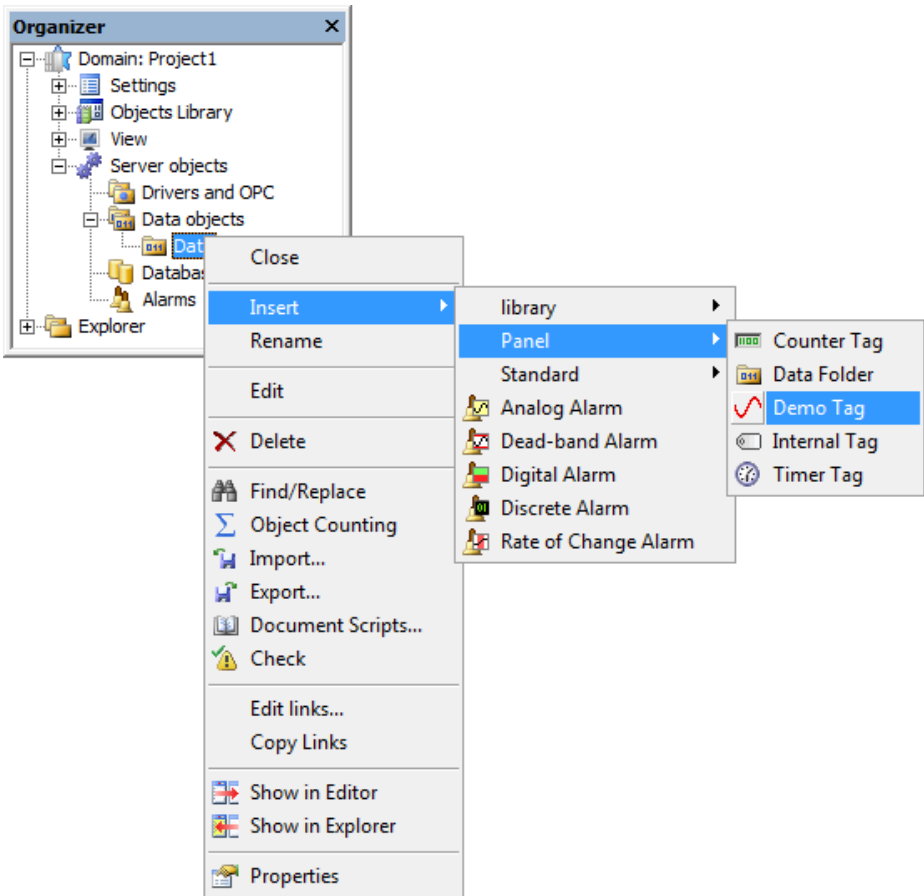
Adding Counter Tags

Some Counter Tag properties can be configured using the Properties List, without creating scripts for this. To configure any property, just locate it on the Properties List and perform the necessary adjustments.

11.3 Demo Tag

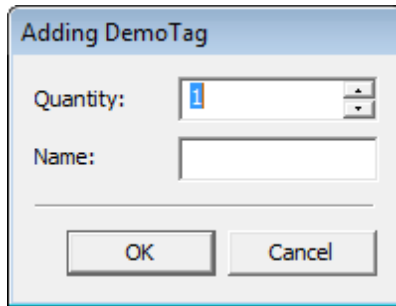
A **Demo Tag** is an object that generates values according to a wave shape, and it is used to simulate values. It allows generating defined waves or random values. To use this resource, follow these procedures:

1. Right-click a Data Server and select the **Insert - Panel - Demo Tag** option.



Inserting a Demo Tag

2. The system opens up a window asking the number of Tags to create in the Server, as well as their names. This name will be auto-incremented; if this option remains blank, Tags will be created with a default name.



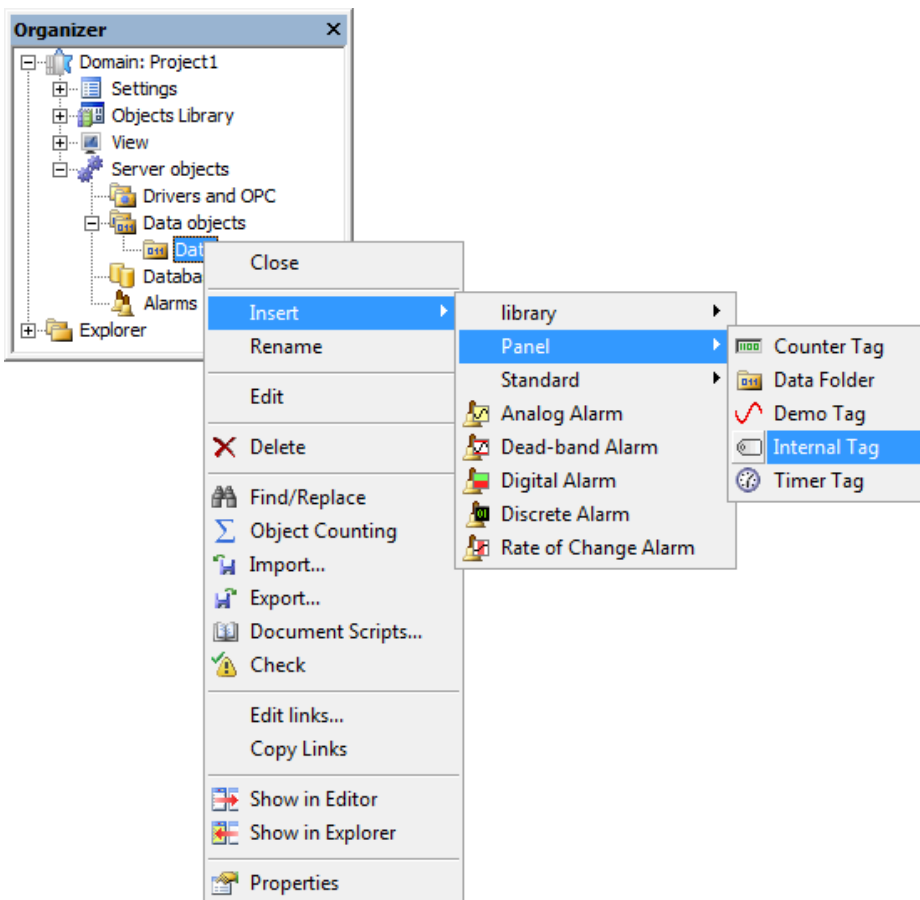
Adding Demo Tags

Some Demo Tag properties can be configured using the Properties List, without creating scripts for this. To configure any property, just locate it on the Properties List and perform the necessary adjustments.

11.4 Internal Tag

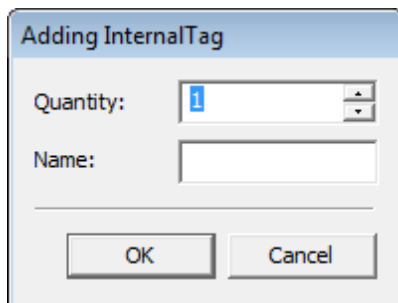
An **Internal Tag** is a general-purpose object, used to store values of any type, including numbers, texts, and even other objects. To use this object, follow these procedures:

1. Right-click a Data Server and select the **Insert - Panel - Internal Tag** option.



Inserting an Internal Tag

- The system opens up a window asking the number of Tags to create in the Server, as well as their names. This name will be auto-incremented; if this option remains blank, Tags will be created with a default name.



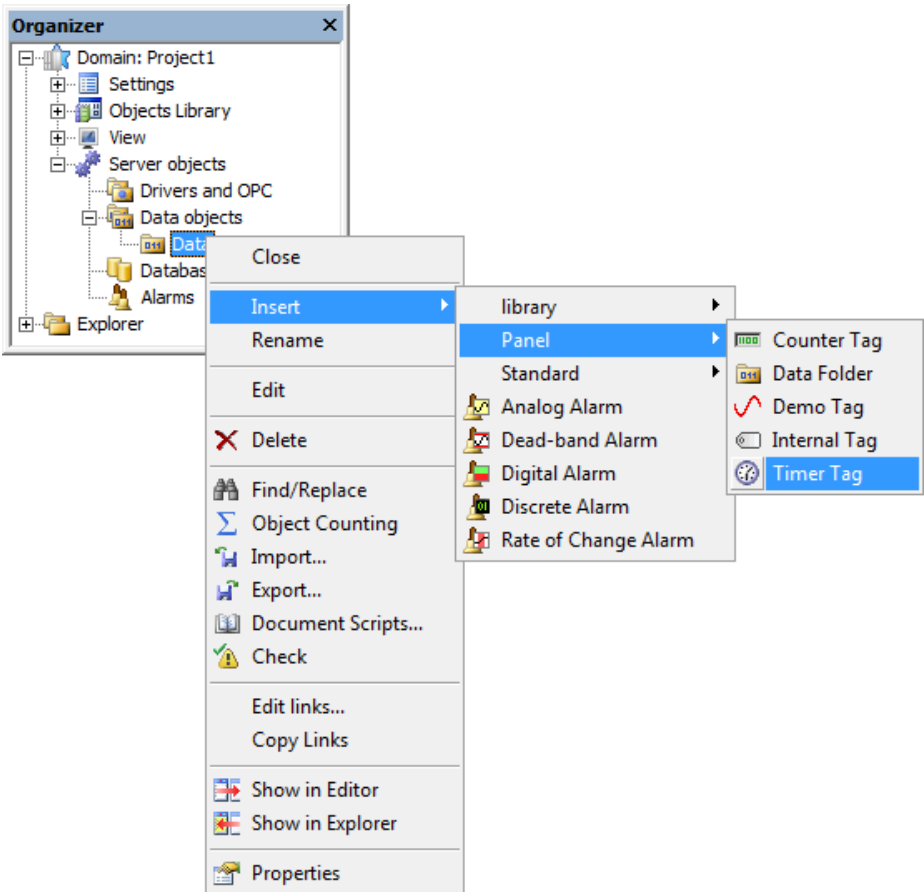
Adding Internal Tags

Some Internal Tag properties can be configured using the Properties List, without creating scripts for this. To configure any property, just locate it on the Properties List and perform the necessary adjustments.

11.5 Timer Tag

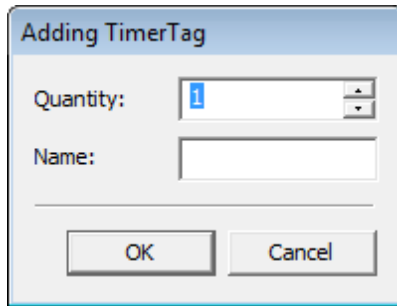
A **Timer Tag** is an object used for counting time and scheduling activities. It establishes a time schedule (with repetitions) to execute certain actions. To use this object, follow these procedures:

1. Right-click a Data Server and select the **Insert - Panel - Timer Tag** option.



Inserting a Timer Tag

2. The system opens up a window asking the number of Tags to create in the Server, as well as their names. This name will be auto-incremented; if this option remains blank, Tags will be created with a default name.

A dialog box titled "Adding TimerTag" with a light blue header. It contains two input fields: "Quantity:" with a spinner box showing the value "1", and "Name:" with an empty text box. At the bottom, there are two buttons: "OK" and "Cancel".

Adding TimerTag

Quantity: 1

Name:

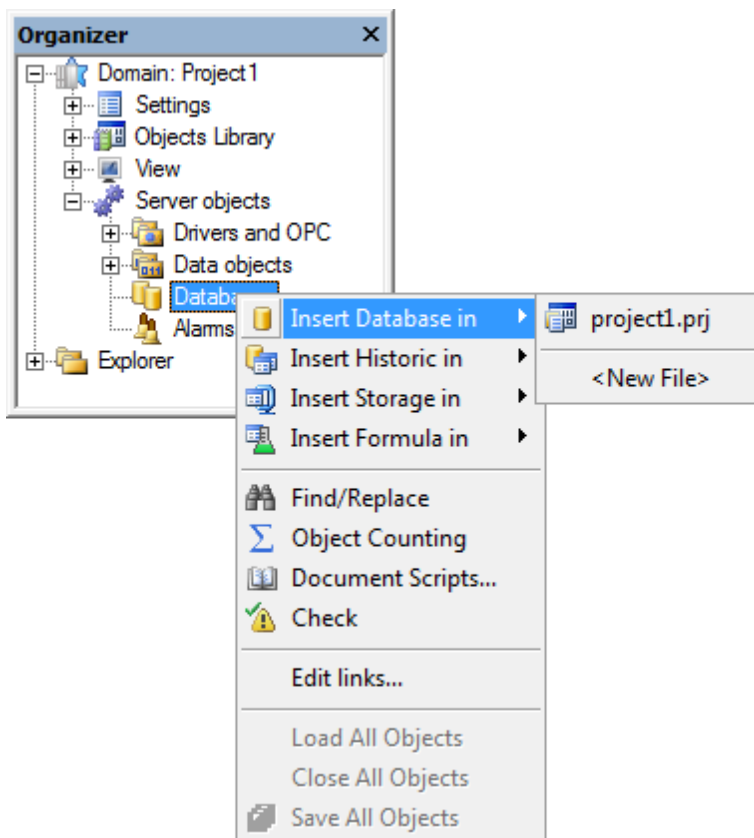
OK Cancel

Adding Timer Tags

Some Timer Tag properties can be configured using the Properties List, without creating scripts for this. To configure any property, just locate it on the Properties List and perform the necessary adjustments.

An E3 **Database** is used to store project information regarding Historic objects, Formulas, Alarms, and Storage. It supports Access (.mdb), Oracle, and Microsoft SQL Server formats.

To use this feature, right-click the project's name in **Explorer** mode and select the **Insert - Database** option. In **Domain** mode, right-click the **Server objects - Databases** option, select the **Insert Database in** option, and then the project's name.



Inserting a Database in Domain mode

When users insert a Database in an application, some options regarding Data Server types are enabled, via **Configuration** tab on Properties window, or via **SourceType** property on Properties List.

Some of this object's properties can be configured via Properties List, without

creating scripts for this. To configure any of these properties, locate it on the Properties List and perform the necessary adjustments. For more information on properties of this object, please check the **Scripts Reference Manual**.

NOTE: A Database object can be configured to work as an **Alarm Area**.

12.1 Access

Generates a database in MDB (*Microsoft Access Database*) format, default database for E3. To use this feature, follow these procedures:

1. Right-click the project's name in Explorer and select the **Insert - Database** option. In **Domain** mode, right-click the **Server objects - Databases** item, select the **Insert Database in** option, and then the project's name. The object is then created, and its script edition window is opened.
2. To configure it, go to the **Configuration** tab on Properties window.

'DB1' properties (DB.DBServer)

Item | Alarms Area | Configuration | Links

Database: 0 - stAccess

Access Database

MDB file: C:\Example\Data.mdb

DB password:

User:

Password:

Test Connection

Configuration for an Access Database

The available options for this tab are described on the next table.

Available options for Configuration tab

OPTION	DESCRIPTION
Database	Selects the project's Database type: 0 - stAccess , 1 - stOracle , or 2 - stSqlServer .
MDB file	Name of an .mdb file used in the project. NOTE: This field accepts an absolute path as well as a path relative to the Domain's current folder. The full path must exist for this .mdb file to be created or found correctly.
DB Password	Access Database password.
User	Database user connected via E3.

OPTION	DESCRIPTION
Password	Password of the user performing the logon.
Test Connection	Tests a connection with the Database.

3. In the **Database** field, select the **0 - stAccess** option.
4. Type the file name (whether it exists or not) in the **MDB file** field (according to the previous figure).
5. If necessary, configure the **User**, **Password**, and **DB Password** options according to Access definitions. These items can remain blank and, in this case, an application assumes E3's default settings.
6. Click **OK** to finish these settings.

12.2 Oracle

Using Oracle as a Database server for E3 is only possible when an Oracle server or client is installed in the machine where E3 server is running. This installation must contain OCI (*Oracle Call Interface*) support and OLEDB Provider for Oracle, required for communication between E3 and Oracle. To install Oracle, please refer to this product's documentation.

Accessing an Oracle database can be performed in two ways: either by accessing an Oracle Database from E3 or via scripts. Each one of these procedures are explained on the next topics.

12.2.1 Accessing Oracle via E3

To insert a new Oracle Database, follow these procedures:

1. Right-click the project's name in Explorer and select the **Insert - Database** option. In **Domain** mode, right-click the **Server objects - Databases** item, select the **Insert Database in** option, and then the project's name. The object is then created, and its script edition window is opened.
2. To configure it, go to the **Configuration** tab on Properties window.

'DB1' properties (DB.DBServer)

Item | Alarms Area | **Configuration** | Links

Database: 1 - stOracle

Oracle Database

Connection:

☐ Use TIMESTAMP type

☐ Use ADO Oracle drivers

User:

Password:

Test Connection

Configuration for an Oracle Database

The available options on this tab are described on the next table.

Available options for Configuration tab

OPTION	DESCRIPTION
Database	Selects the project's Database type: 0 - stAccess , 1 - stOracle , or 2 - stSqlServer .
Connection	Name of the connection, provided by a database administrator.

OPTION	DESCRIPTION
Use TIMESTAMP type	Allows using Oracle's TIMESTAMP -type, with a precision of milliseconds, and available since version 9.0. In case this option is disabled, uses a DATE -type, with a precision of seconds. NOTE: For an E3 Query object to be compatible with tables using a TIMESTAMP -type, users must enable the Use ADO Oracle drivers option.
Use ADO Oracle drivers	Allows using Oracle's ADO (<i>ActiveX Data Objects</i>) interfaces, so that an E3 Query object recognizes a TIMESTAMP -type. Thus, it is possible to read records from Oracle tables with a precision of milliseconds.
User	Database user, connected via E3.
Password	Password of the user performing the logon.
Test Connection	Tests connection with the Database.

3. In the **Database** field, select the **1 - stOracle** option.
4. If the Oracle server is a local server, the **Connection** field may remain blank, because E3 automatically retrieves this information. Otherwise, the connection is created using an Oracle client installed in the machine.
5. If necessary, configure the **User** and **Password** options according to Oracle settings. Such items may remain blank and, in this case, an application assumes E3 default configurations.
6. Click **OK** to finish these settings.

When inserting a Database in an application, some options regarding Database Server types are enabled. A Database Server is responsible for managing and storing information about objects that use this service.

12.2.2 Accessing Oracle via Scripts

Scripts are programming language modules, in which users can create source code that allows great flexibility to associate actions to specific events. Each item of an E3 project has a list of previously associated events. So, users can create programs that are executed whenever an event occurs.

E3 uses VBScript (*Visual Basic Script*) in its scripts, and thus it can instantiate any system-registered ActiveX object. To access a Database, the most commonly used ActiveX is ADO (*ActiveX Data Object*), which can be easily handled in E3 scripts.

First, it is necessary to create an ADO connection, which can be performed by using

the following script:

```
Set DBConnection = CreateObject("ADODB.Connection")
DBConnection.Open "Provider=MSDAORA;_
DataSource=connectionOracle;User_
ID=UserID;Password=passwd"
```

After creating a connection, users can run a SQL command directly through that connection, as shown next:

```
DBConnection.Run _
"UPDATE Table SET name = 'John' WHERE id = 10"
```

Users can also view all records, which are returned as a Recordset (query), as shown next:

```
Set Recordset = CreateObject("ADODB.Recordset")
Recordset.Source = "Table"
Recordset.ActiveConnection = DbConnection
Recordset.CursorType = 1 ' adOpenKeyset
Recordset.LockType = 3 ' adLockOptimistic
Recordset.Open
```

Then users can browse the returned table by using the **MoveNext** and **MovePrevious** commands, as well as many other ADO commands. Users can also use a SQL query to handle specific parts of a table, by using the **Source** property.

12.2.3 Technologies Used by E3 for Accessing Oracle

E3 basically uses two technologies to access Oracle Databases: **ADO** (*ActiveX Data Object*) and **OCI** (*Oracle Call Interface*).

ADO is a technology used by E3Browser and E3Chart to retrieve data stored in a Database. ADO is also widely used in E3 scripts for all types of operations with a Database. It is a set of COM (*Component Object Model*) objects created to access DBMS information, by using OLE DB (*Object Linking and Embedding*). This technology is available when installing OLE DB Provider for Oracle (MSDAORA) and allows access to Oracle's native interface, OCI.

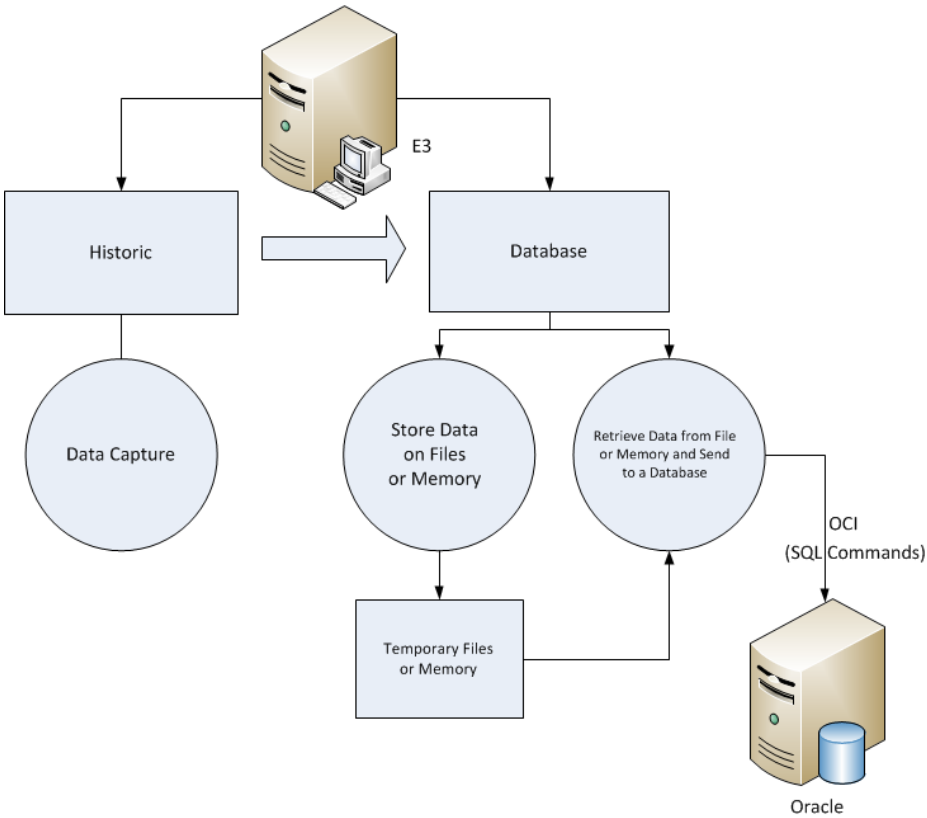
OCI is used by E3's Database Server to implement Database services used by Historic objects, Formulas, Alarms, and Storage. With OCI, users have direct access to Oracle functions, making this process as optimized as possible. It provides a default Database access library and data retrieval functions as a DLL or LIB, which can be linked to an application at run time.

12.2.4 Accessing Oracle via Database Server

E3's Database Server uses OCI (*Oracle Call Interface*) to communicate with an Oracle server, that is, it uses Database's native form to improve communication performance with a Database.

A good example on how E3's Database Server communication with Oracle works is the Historic object. First, data acquisition is performed by a Historic that, with this data, immediately sends it as a request to a Database. These requests can be for creating a table, creating indexes and keys, adding data, etc. E3's Database Server has a separated process specially designed to receive them. Depending on the type of operation to perform, data is formatted and saved in a temporary file or in memory.

At the same time, a Database has another process, responsible for retrieving requests and sending them to a database as SQL commands, by using OCI.



Communication between E3 and Oracle

12.3 SQL Server

With this option, users can store data in a SQL Server Database.

12.3.1 Accessing SQL Server via E3

To insert a new SQL Server Database, follow these procedures:

1. Right-click the project's icon and select the **Insert - Database** option. The object is then created and its script edition window is opened.
2. To configure it, select the **Configuration** tab on Properties window.

'DB1' properties (DB.DBServer)

Item | Alarms Area | **Configuration** | Links

Database: 2 - stSqlServer

SQL Server Database

Server:

Database:

Network Library: 0 - Default

☐ Change connection string:

Provider=SQLOLEDB.1;Persist Security Info=False;Initial Catalog={DB};Data Source={SERVER}

Connection string may have the following macros:
{SERVER} - server name
{DB} - database name

User:

Password:

Test Connection

Configuration for SQL Server Databases

The available options on this tab are described on the next table.

Available options for Configuration tab

OPTION	DESCRIPTION
Database	Selects the project's Database type: 0 - stAccess , 1 - stOracle , or 2 - stSqlServer .

OPTION	DESCRIPTION
Server	Server name.
Database	Database name.
Network Library	Network library used by ADO: 0 - Default, 1 - Named Pipes, 2 - Winsock TCP/IP, 3 - SPX/IPX, 4 - Banyan Vines, or 5 - Multi-Protocol (RCP).
Change connection string	This check box allows changing the String to connect to a SQL Server database. The following restrictions apply to this option: <ul style="list-style-type: none"> • Performed changes ARE NOT validated by E3. Therefore, users are fully responsible for configuring this customized String correctly. • If this check box is not selected, E3 uses a default format to perform this connection. • This connection String accepts two macros: {SERVER}, which is replaced by server's name configured in the Server field and {DB}, which is replaced by database's name configured in the Database field.
User	Database user connected via E3. Depending on the type of object to use in the project, they must have different kinds of permissions.
Password	Password of the user performing the logon.
Test Connection	Tests the connection with the Database.

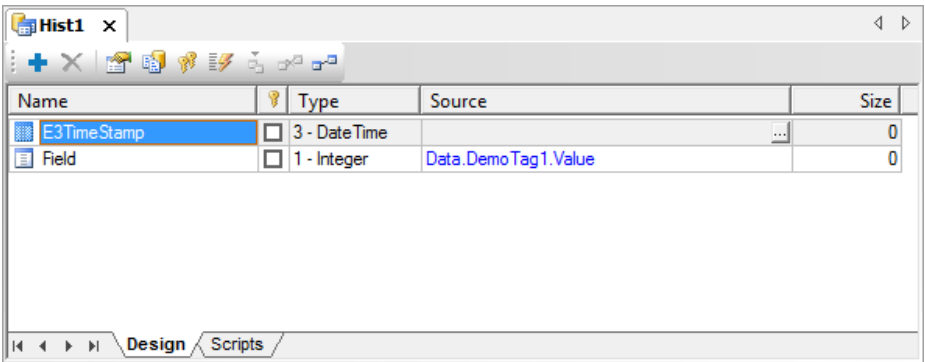
3. In the **Database** field, select the **2 - stSqlServer** option.
4. If necessary, configure the **User** and **Password** options according to SQL Server's definitions. These items may remain blank and, in this case, an application assumes E3's default settings.
5. Click **OK** to finish these settings.

12.3.2 Example of SQL Server 2000 Usage



To illustrate access to SQL Server 2000, users can create a Historic that records data with a scan time of one second. To do so, follow these procedures:

1. Create a Demo Tag. This Tag's settings do not need to be changed.
2. Double-click the Database Server to open SQL Server's setup window. These parameters must be changed, so that they fit available settings during SQL Server installation.
3. Perform all configurations needed on this window, such as server's name, user, password, and Database.

- Once Database setup is finished, users must configure a Historic object to access this database. To do so, users must first create a field in the Historic and then insert the Demo Tag, which is used to send different values to a Database.



Historic object and its settings

- Open the Historic Properties window, by clicking **Historic Properties**  and specify both a Database server and a table name. Other settings must remain unchanged. This table retrieves data from E3 and also views SQL Server Analyzer's usage, which is a client used for queries in SQL Server.
- Once Historic is configured, users must create a table structure in the Database Server. To do so, click **Generate structure** . A message confirming the creation of this table structure is displayed. In case of any error, users should try to revise their settings.
- To view this Historic in action (saving data to a SQL Server), create a Screen, insert an E3Browser, and configure it to access the Database Server, as previously explained in the Historic, and configure this E3Browser to be automatically updated every 10 seconds, for example.
- Once this configuration is finished, execute the project. After some time executing, E3Browser starts displaying data sent to this server.
- Users can consolidate data to display in E3 and stored in the server by using an E3Browser's Query object, and SQL Query Analyzer. To do so, create different queries on the Database and edit them both in the Query object and in Query Analyzer. The results must be the same if Domain is stopped, and similar if Domain is running. This difference is due to constant Database updates when a Domain is running. To edit queries in a Query object, enable the **Enable SQL direct edition** option.

12.3.3 Using ADODB for Access via Script

To access a SQL Server via scripts, use an ADODB connection. A connection **String** for this type of Database is defined as the following template:

```
DRIVER={SQL Server};SERVER=server;UID=login_id;PWD=password;
```

Using this type of access must be restricted to cases when there is no other solution. E3 provides features that aim at minimizing database access via script. However, on some circumstances this feature may be necessary.

12.4 E3 Objects and Permissions

It is necessary to configure permissions in a Database to use E3 objects in a project. These permissions are listed on the next table.

Available options for permissions

OBJECT	PERMISSION
Formula	Full permission
User historic	Reads and queries existing tables
Historic	Full permission
Alarm Server	Full permission

In permissions, a **Full permission** expression means users have permission to:

- Create or remove existing tables
- Create indexes and keys
- Insert and exclude data from tables already created
- Perform queries on resulting tables

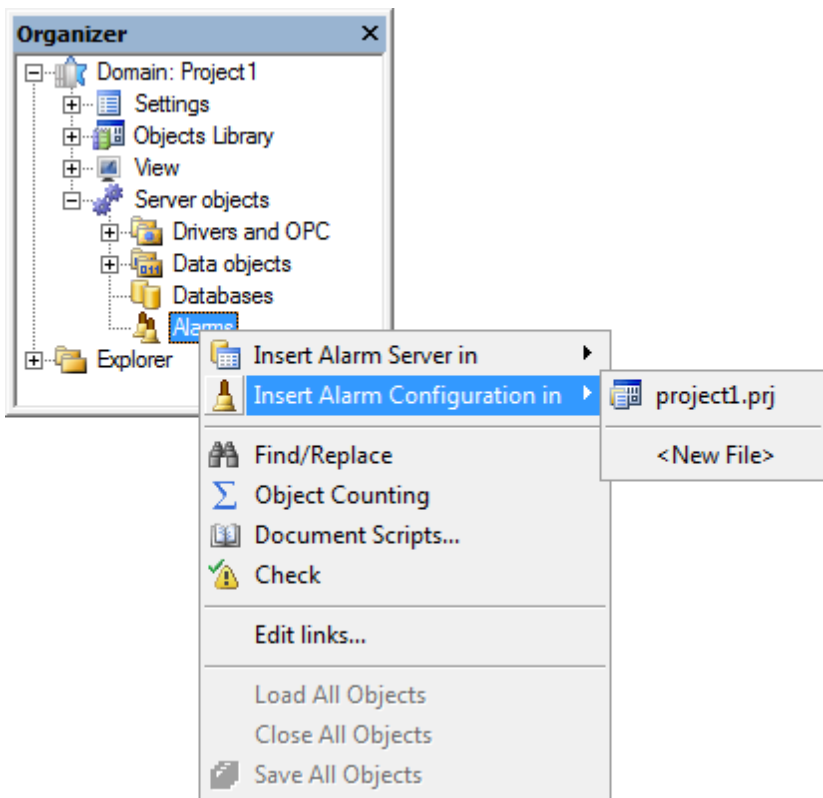
Users do not need to be Administrators to have Full Permission on any object.

E3 provides a set of objects that allows users to monitor alarms in an application. With them, users can specify and manage alarms and events of process variables. Alarm conditions can be managed in several sources. This system is formed by a centralizing object, named **Alarm Server**, and one or more configuration objects, named **Alarm Configuration**. The next topics contain detailed information about these objects.

13.1 Alarm Configuration

An **Alarm Configuration** object is where Alarm Areas are inserted and organized. To insert this object in a project, follow this procedure:

1. Right-click the project's name in **Explorer** mode and select the **Insert - Alarm Configuration** option. In **Domain** mode, right-click the **Server Objects - Alarms** item, select the **Insert Alarm Configuration in** option, and then the project's name.



Inserting an Alarm Configuration

13.1.1 Alarm Areas

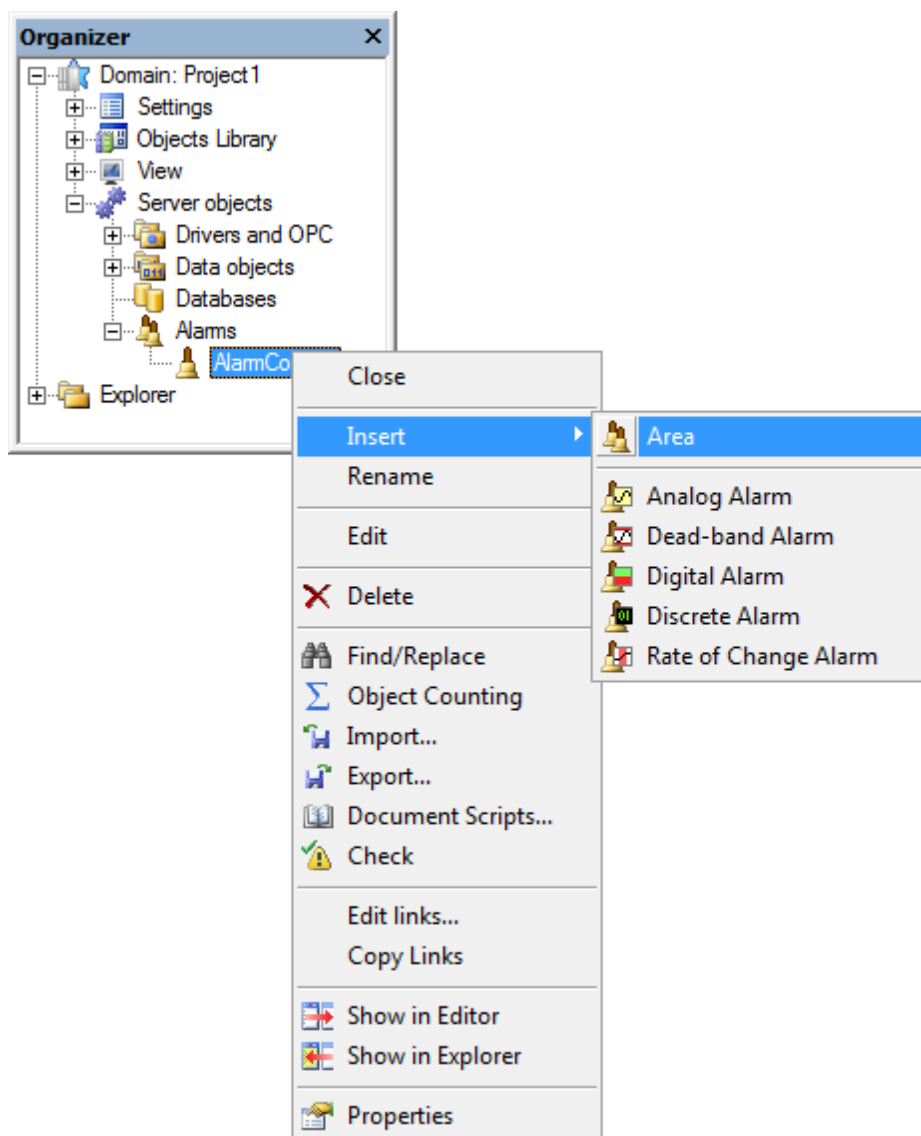
Alarm Areas allow grouping a set of Alarm Sources, as well as other Areas. This makes managing, operating, and monitoring a set of related alarm sources easier, such as:

- Filtering a visible set of alarms in the summary
- Enabling or disabling a set of Alarm Sources
- Acknowledging a set of Alarm Sources
- Checking the total amount of active or unacknowledged alarms of a set of Alarm Sources

If needed, new Areas can be inserted within others. To insert this object, follow this procedure:

1. Right-click the Alarm Configuration object or an Area object in **Explorer** mode and select the **Insert - Area** option. In **Domain** mode, right-click the Alarm

Configuration object and select the **Insert - Area** item.



Inserting an Alarm Area

Some properties of this object can be configured in the Properties List, without scripts. To configure any property, locate it on the Properties List and proceed with the necessary adjustments. More information on the functionality of this object's properties can be found on the **Scripts Reference Manual**, in its respective chapter.

13.1.1.1 Server Objects as Alarm Areas

Server objects have the possibility of behaving as Alarm Areas. These objects now have an additional tab, **Alarms Area**, where this behavior can be enabled and configured. The next figure shows that tab on an I/O Driver.



Alarms Area tab

The available options on this tab are described on the next table.

Available options on Alarms Area tab

OPTION	DESCRIPTION
Work as alarms area	Enables or disables an Alarm Area behavior for this Server object. This option corresponds to the IsAlarmArea property.
Check alarms	Enables or disables alarm check on this object. This option corresponds to the AlarmVerify property.
User fields	Please check topic User Fields Settings for more information.

The following properties become available on a Server object:

- **ActiveAlarms**

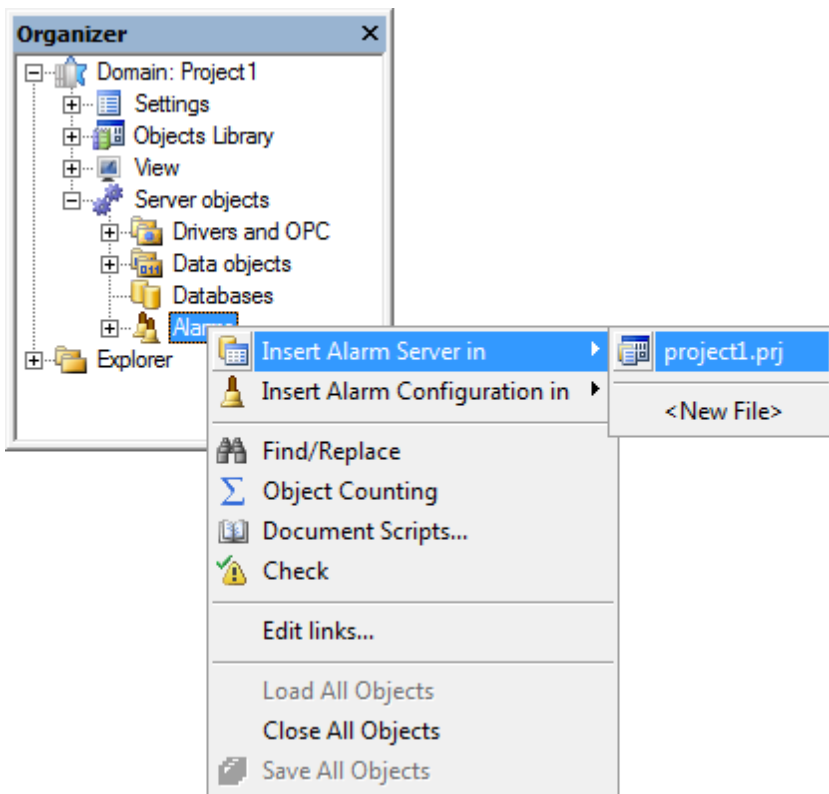
- **ActiveHighAlarms**
- **ActiveHighNACKAlarms**
- **ActiveLowAlarms**
- **ActiveLowNACKAlarms**
- **ActiveMedAlarms**
- **ActiveMedNACKAlarms**
- **ActiveNACKAlarms**
- **Alarm**
- **AlarmVerify**
- **UserFields**

13.2 Alarm Server

An **Alarm Server** object centralizes all project's alarms. In it, users can find the total amount of active alarms in an application, acknowledged or not. This object is also responsible for reporting alarm events to all connected Viewers, as well as sending these events to a database, if necessary.

An application can only have one object of this type, and its presence is mandatory to perform an alarm verification. To insert an Alarm Server, follow this procedure:

1. Right-click the project's name in **Explorer** mode and select the **Insert - Alarm Server** option. In **Domain** mode, right-click the **Server objects - Alarms** item, select the **Insert Alarm Server in** option, and then the project's name.



Inserting an Alarm Server in Domain mode

13.2.1 Configurations for Alarm Table Generation

To specify configurations for an Alarm Server, right-click this object and select the **Properties** option.

On **Configuration** tab, users can specify Database settings and determine fields to generate an alarm table.

'AlarmServer1' properties (DB.AlarmServer)

Item Configuration User fields Links

☒ Store alarms on a database

Database Server:

Table name:

☒ Discard data from the main table

Discard data older than:

Perform discard every:

☒ Move discarded data to the backup table

Discard from backup data older than:

Fields configuration

Define which alarm event fields will be recorded

Database structure creation

Click the button to create the alarm tables

Configuration tab

Each field on **Configuration** tab has a corresponding property. The available options on this tab are described on the next table.

Available options for Configuration tab

OPTION	DESCRIPTION
Store alarms on a database	Enables or disables alarm data storage on a Database. This field is equivalent to the Logging property.
Database Server	Defines which Database server stores alarm data. This field is equivalent to the DataSource property.
Table name	Defines the name of an alarm table. This field is equivalent to the TableName property.

OPTION	DESCRIPTION
Discard data from the main table	Enables or disables discarding data from the main table. Data is considered old according to the Discard data older than option. This field is equivalent to the EnableDiscard property.
Discard data older than	Determines a time interval (minutes, hours, days, or months) during which data is kept on the main table. If data is older than the interval on this option, it is discarded. This field is equivalent to the DiscardInterval property and the field to select a time unit for this interval is equivalent to the DiscardTimeUnit property.
Perform discard every	Performs an alarm verification, according to the period specified in this field (minutes, hours, days, or months). This field is equivalent to the VerificationInterval property and the field to select a time unit for this interval is equivalent to the VerificationUnit property.
Move discarded data to the backup table	Enables or disables storing discarded data on a secondary table (backup table). This field is equivalent to the EnableBackupTable property.
Discard from backup data older than	Determines a maximum time interval (minutes, hours, days, or months) for data on the backup table until it is discarded, regardless of the time data remains on the main table. For example, to keep data for 24 months on the main table and six more months on the backup table, this option's value must be 30 months. This interval must be longer than the one configured in the Discard data older than option of the main table. This field is equivalent to the BackupDiscardInterval property and the field to select a time unit for this interval is equivalent to the BackupDiscardTimeUnit property.
Fields	Determines which alarm's event fields are added to the alarm table, and in which order those columns are displayed.
Create table	Generates an alarm table on the specified Database.

The available fields on the Alarm Server to generate an alarm table are described on the next table.

Available fields for Alarm field tables

OPTION	DESCRIPTION
Acked	Informs whether an alarm was acknowledged or not. This field assumes values 0: Not acknowledged or 1: Acknowledged .
AckRequired	Determines an automatic acknowledgment of this alarm. This field assumes values 0: Automatic acknowledgment or 1: Manual acknowledgment .
AckTime	Stores E3's date and time at the moment an alarm is acknowledged, or zero (12/30/1899) while it is not acknowledged. For alarms that do not require acknowledgment, this field assumes E3's time stamp at the moment this alarm becomes active.
AckTimeDbI	Similar to the previous field. It is used to store Double data types for Oracle or SQL Server databases.
ActorID	<p>Name of the operator who acknowledged this alarm. It can be:</p> <ul style="list-style-type: none"> • The user logged on Viewer when acknowledgment happened on E3Alarm (or "No user", if there is no user logged in) • "System", when acknowledgment is automatic, that is, for alarms that do not require acknowledgment • A name passed via script (for example, by using Alarm Server's AckArea, AckAllAlarms, or LogTrackingEvent, or Alarm Source's Ack) <p>This field's limit is 50 characters, when stored on a Database.</p>
AlarmSourceName	Stores Alarm Source's name. This field's limit is 100 characters, when stored on a Database.
Area	For alarm events, this is the name of the Area this Alarm Source belongs to. For other events (for example, by using Alarm Server's LogTrackingEvent method), it can be a user-defined text. This field's limit is 100 characters, when stored on a Database.
ChangeMask	Not used and its value is always 0 (zero).

OPTION	DESCRIPTION
ConditionActive	Indicates whether this Alarm Source is in alarm. This field assumes values 0: Inactive condition or 1: Active condition .
ConditionName	<p>Name of this condition, if it is an alarm event. This field presents the following values:</p> <ul style="list-style-type: none"> • DeadBand: Dead Band-type Alarm Source • Digital: Digital-type Alarm Source • Level: Analog-type Alarm Source • RateOfChange: Rate Of Change-type Alarm Source <p>If this event is not an alarm (for example, when using Alarm Server's LogTrackingEvent method), this value is always an empty String. This field's limit is 100 characters, when stored on a Database.</p>
Cookie	Value associated to this Alarm Source, used internally by an Alarm Server.
CurrentValue	Determines Alarm Source's value (converted to Double) at the time of the event. For other events (for example, by using Alarm Server's LogTrackingEvent method), this value is always zero (0). The field's limit is 100 characters, when stored on a Database.
Enabled	Determines whether alarm check is enabled or not. This field assumes values 0: Alarm source's check disabled or 1: Alarm source's check enabled .
EventCategory	<p>Category of this event. For alarms, this field may assume the following values:</p> <ul style="list-style-type: none"> • DeadBand: Dead Band-type Alarm Source • Digital: Digital-type Alarm Source • Level: Analog-type Alarm Source • RateOfChange: Rate Of Change-type Alarm Source <p>For other events (for example, when using Alarm Server's LogTrackingEvent method), it may assume user-defined values. This field's limit is 100 characters, when stored on a Database.</p>
EventCLSID	Unique identifier for alarm's lifetime. When a new alarm occurs on a Source, a new <i>EventCLSID</i> number is then generated. Thus, it keeps the same CLSID on the Database while it is still on the list of active and unacknowledged alarms.
EventTime	Date and time of an Alarm Source's value at the time of an event.

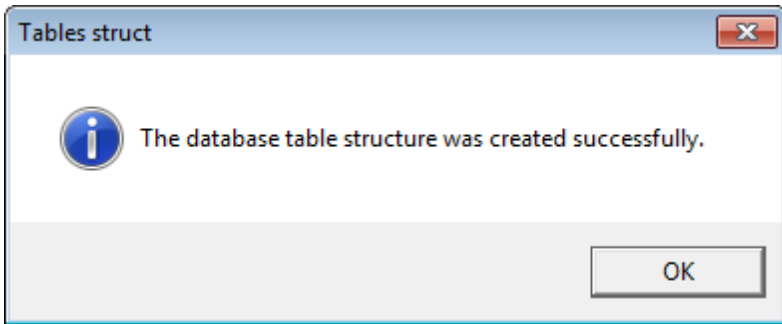
OPTION	DESCRIPTION
EventTimeDbI	Similar to the previous field. It is used to store a Double data type for Oracle or SQL Server databases.
EventTimeUTC	Date and time of an Alarm Source's value at the time of an event relative to Greenwich time. Its value is the same as the EventTime field, and it is kept in E3 for compatibility reasons.
EventType	Type of an event. For alarm events, it is always Condition . For other events, it can be a user-defined text, such as when using Alarm Server's LogTrackingEvent method ("Tracking", "Simple", etc.). This field's limit is 100 characters, when stored on a Database.
FormattedValue	Shows Alarm Source's formatted value for its event. This field's limit is 100 characters, when stored on a Database. NOTE: This is a read-only field.
FullAlarmSourceName	Stores Alarm Source's full path, including Areas, Alarm Configuration, and possible Folders where it might be inserted. For example, Folder1.AlarmConfig1.Area1.AlarmSource1 .
InTime	Stores value's date and time, at the moment it enters an alarm condition.
InTimeDbI	Similar to the previous field. It is used to store a Double data type for Oracle or SQL Server databases.
Message	Text configured on an Alarm Source, or specified by another event (for example, by using Alarm Server's LogTrackingEvent method). This field's limit is 200 characters, when stored on a Database.
OutTime	Stores value's date and time at the moment it leaves an alarm condition, or zero (12/30/1899) if this alarm has not left its active condition yet.
OutTimeDbI	Similar to the previous field. It is used to store a Double data type for Oracle or SQL Server databases.

OPTION	DESCRIPTION
Quality	<p>Quality of Alarm Source's value, at the moment of an event. This field assumes the following numerical values:</p> <ul style="list-style-type: none"> • 0 - 63: Bad quality • 64 - 127: Uncertain quality • 128 - 191: Undefined value • 192 - 255: Good quality <p>If this event is not an alarm (for example, by using Alarm Server's LogTrackingEvent method), this field is equal to an empty String. Example: Bad (0); Uncertain (64); ?? (128); Good (192).</p>
Severity	<p>Severity value configured on an Alarm Source. This field assumes values 0: High, 1: Medium, or 2: Low. It can also assume another user-defined value if it is an event, such as when using Alarm Server's LogTrackingEvent method.</p>
Source	<p>For alarm events, it informs an expression used to evaluate alarm conditions. This field's limit is 100 characters, when stored on a Database.</p>
SubConditionName	<p>Name of a sub-condition, if it is an alarm event. This field can assume the following values:</p> <ul style="list-style-type: none"> • DB: Dead Band Alarm • DIG: Digital Alarm • RC: Rate Of Change Alarm • LOLO: Analog Alarm in LoLo range • LO: Analog Alarm in Lo range • HI: Analog Alarm in Hi range • HIHI: Analog Alarm in HiHi range <p>If this event is not an alarm (for example, when using Alarm Server's LogTrackingEvent method), it is always an empty String. This field's limit is 100 characters, when stored on a Database.</p>
User Fields	<p>These are user-defined fields. They are configured on Alarm Server's User fields tab.</p>

NOTES:

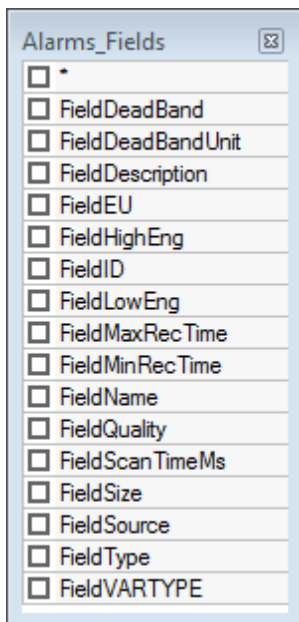
- To monitor alarms, users must have an Alarm Server configured in the Domain.
- **EventTimeMS**, **InTimeMS**, **OutTimeMS**, and **AckTimeMS** fields contain milliseconds from **EventTime**, **InTime**, **OutTime**, and **AckTime** fields, respectively. These fields are used when it is necessary to store event times, in milliseconds, on an Oracle database server. Notice that these fields are not available in E3Alarm, because in this object it is possible to view milliseconds by using Date and Time column's format.

After defining all these configurations, an application starts inserting and storing information on the alarm table, according to field specifications. When clicking **Create Table**, Studio generates an alarm's data table according to these specifications, and informs whether this table was successfully generated.



Alarm Server message

The structure of an alarm table is similar to a Historic object, composed by a definitions table, a main table, and a backup table (optional).



The screenshot shows a window titled "Alarms_Fields" with a close button in the top right corner. Inside the window is a list of fields, each preceded by an unchecked checkbox. The fields are: *, FieldDeadBand, FieldDeadBandUnit, FieldDescription, FieldEU, FieldHighEng, FieldID, FieldLowEng, FieldMaxRecTime, FieldMinRecTime, FieldName, FieldQuality, FieldScanTimeMs, FieldSize, FieldSource, FieldType, and FieldVARTYPE.

Field Name
*
FieldDeadBand
FieldDeadBandUnit
FieldDescription
FieldEU
FieldHighEng
FieldID
FieldLowEng
FieldMaxRecTime
FieldMinRecTime
FieldName
FieldQuality
FieldScanTimeMs
FieldSize
FieldSource
FieldType
FieldVARTYPE

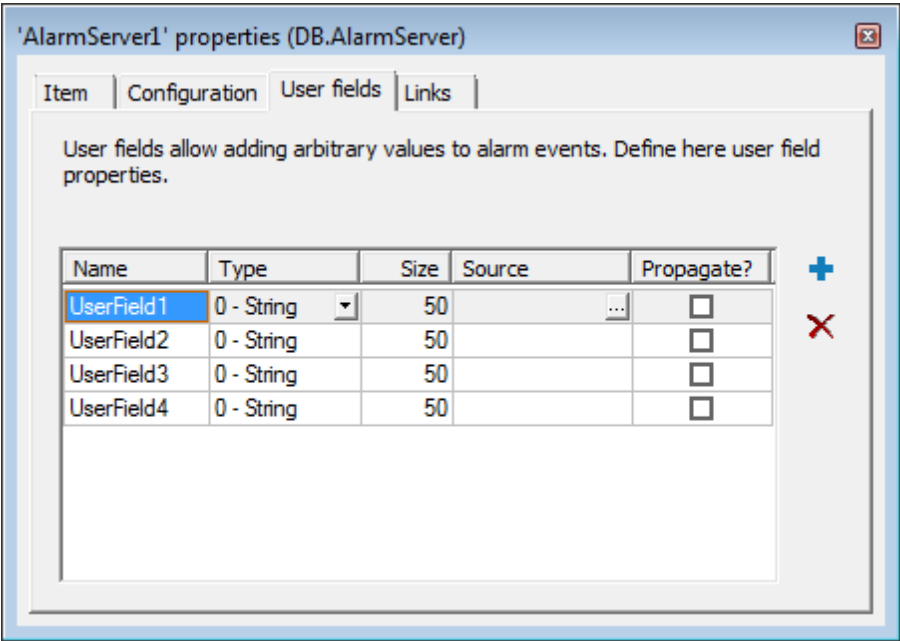
Fields table

Fields generated on this table are explained on **Table Settings** topic of **Historic** chapter.

By using Alarm Server's configuration window, users can specify a Database Server used to store alarms. A Database Server (DBServer object) is an E3 module that must be inserted in an application.

13.2.2 User Fields Settings

The **User fields** tab allows adding arbitrary values to alarm events.



User fields tab

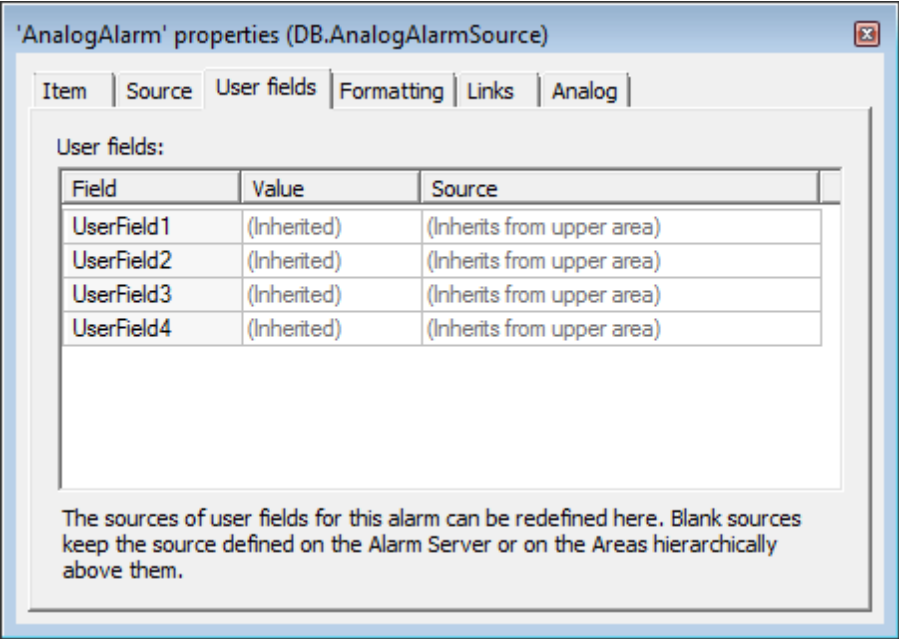
The available options on this tab are described on the next table.

Available options on User fields tab

OPTION	DESCRIPTION
Name	Specifies this Field's name.
Type	Specifies this Field's type (0: String, 1: Integer, 2: Double, or 3: DateTime).
Size	Specifies this Field's size.
Source	Specifies this Alarm's data source.
Propagate?	Forces an immediate update on all alarms that inherit this User Field's value, whenever it receives a forced value or if its Link changes.
	Adds a User Field at the end of this list.
	Removes the last User Field on this list.

User Fields can only be included or excluded at the end of this list. Excluding User Fields from this list reflects on all Alarm Areas and Sources related to this Alarm Server, but only if the removed Fields were not configured with a forced value or a

Link. Otherwise, these Fields still appear on Alarm Areas and Sources. The next figure shows an Analog Alarm with User Fields inherited from an Alarm Server.



Inherited User Fields

NOTE: For more information about the behavior of a User Field from Alarm Areas and Sources, in Studio and at run time, please check the **Link**, **Value**, and **ValueSource** properties on **Scripts Reference Manual**.

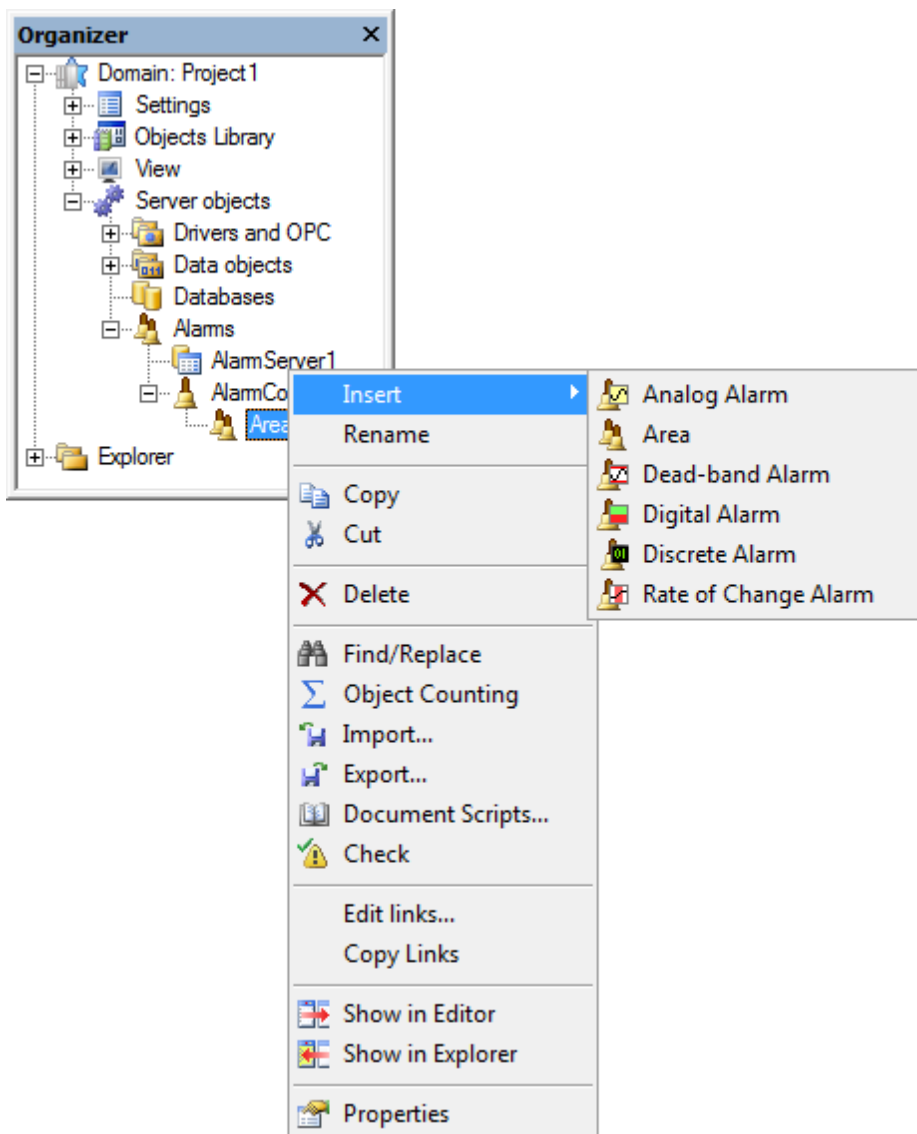
13.3 Alarm Sources

All information relative to alarm conditions is defined in **Alarm Sources**, as well as event types that must be generated for each condition. Alarm Sources always contain an alarm expression (a data source), whose value can be checked according to several available conditions. These sources are **Analog**, **Dead Band**, **Digital**, **Rate of Change**, and **Discrete**.

NOTE: An Alarm Source object can be created inside any Server object.

To insert this object, follow this procedure:

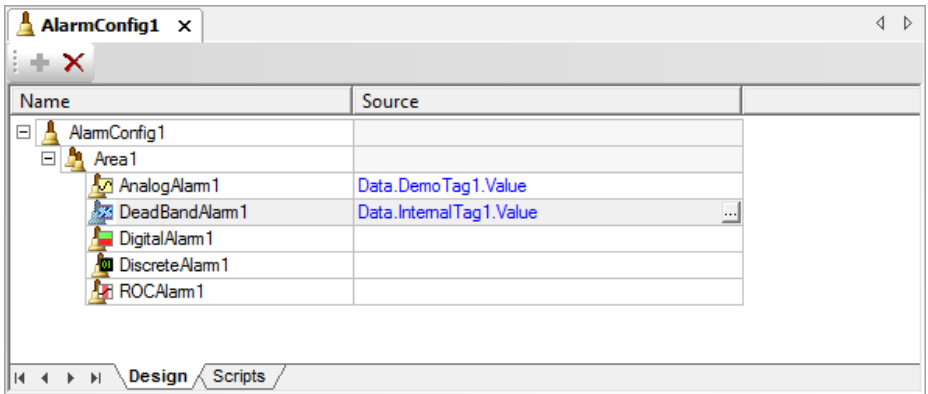
1. Right-click the Server object in **Explorer** mode and select the **Insert - Alarm** option (**Analog**, **Dead Band**, **Digital**, **Discrete**, or **Rate of Change**). In **Domain** mode, select the desired object in **Server objects** item and select the **Insert - Alarm** option (**Analog**, **Dead Band**, **Digital**, **Discrete**, or **Rate of Change**).



Inserting an Alarm Source

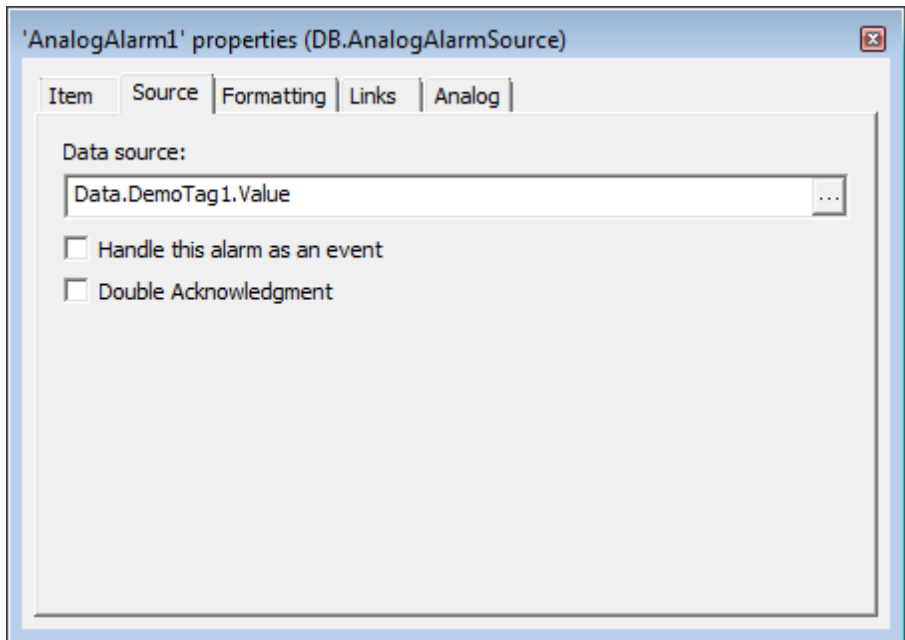
Some of these object's properties can be configured on the Properties List, without scripts. To configure any property, locate it on the Properties List and proceed with the necessary adjustments. More information on the functionality of this object's properties can be found on the **Scripts Reference Manual**.

In each alarm sub-condition, users can configure its limits, an event-related message, its severity, as well as the need for acknowledging this event or not.



Alarm Sources

When opening the Properties window of any Alarm Source and selecting the **Source** tab, the window on the next figure is then opened.



Source tab

To handle this Alarm as an event, or to double acknowledge this alarm (when it is active as well as when it becomes inactive), click the corresponding check box. All Alarm Sources have the following general properties:

- **Message Text:** This message is stored in alarm event's **Message** field while it is active, that is, it can be viewed on an E3Alarm (alarm summary), stored on a Database, etc. This message text is limited to 200 characters

- **Severity:** Indicates the severity of an alarm (**Low**, **Medium**, or **High**). The **Severity** field is used for building filters and for sorting messages
- **Need Ack:** Indicates whether this alarm must be acknowledged by an operator to be removed from E3Alarm's alarm list, or if it is automatically acknowledged when a variable leaves an alarm condition
- **Return Message:** This message is stored in the alarm event's **Message** field when it is inactive, that is, it can be viewed on an E3Alarm (alarm summary), stored on a Database, etc.

There are several types of Alarm Sources that can be inserted into Server objects. The available options are described on the next topics.

13.3.1 Analog

Allows monitoring an analog variable by specifying up to four alarm levels, which are **LoLo** (Very Low), **Lo** (Low), **Hi** (High), and **HiHi** (Very High).

Analog tab

The available options on this tab are described on the next table.

Available options for Analog tab

OPTION	DESCRIPTION
Enabling (LoLo, Lo, Hi, HiHi)	Enables checking the selected alarm type.

OPTION	DESCRIPTION
Limit	Indicates a level in which this alarm is triggered.
Message text	Allows specifying a text displayed to users when this alarm is in an active condition.
Severity	Specifies an alarm level's severity (it can be High , Medium , or Low).
Need Ack	Enables or disables alarm acknowledgment.
Event	Enables or disables handling each alarm sub-condition as an event.
Delay	Specifies a delay time, in milliseconds. When this value is equal to 0 (zero, default), no delay is applied.
Deadband	Enables a dead band, which is a feature used to avoid that a variable, when oscillating around an alarm's limit, generates an unnecessary amount of messages.
Return Message	Allows specifying a text displayed to users when this alarm is not in an active condition.

13.3.2 Digital

Allows monitoring a digital variable by specifying whether this alarm is rising (-1 or True) or falling (0 or False).

'DigitalAlarm1' properties (DB.DigitalAlarmSource)

Item | Source | Formatting | Links | Digital

☐ Digital Alarm:

Value: Message text: Severity: Need ACK: ☒

Delay (ms):

Return message:

Digital tab

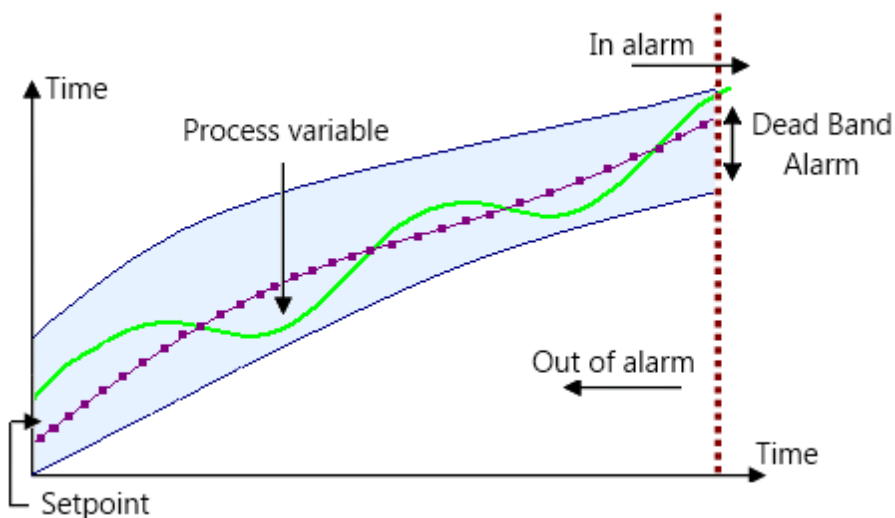
The available options on this tab are described on the next table.

Available options for Digital tab

OPTION	DESCRIPTION
Digital Alarm	Enables a digital alarm.
Value	Determines a Boolean value for this alarm (True or False).
Message Text	Allows specifying a text displayed to users when this alarm is in an active condition.
Severity	Specifies an alarm level's severity (it can be High , Medium , or Low).
Need Ack	Enables or disables alarm acknowledgment.
Delay (ms)	Specifies a delay time, in milliseconds. When this value is equal to 0 (zero, default), no delay is applied.
Return message	Allows specifying a text displayed to users when this alarm is not in an active condition.

13.3.3 Dead Band

Allows monitoring an analog variable by specifying a maximum difference limit (a dead band value), relative to a reference value (a SetPoint).



Dead Band

This type of alarm is indicated when a reference (SetPoint) varies, and also when users want to avoid an unnecessary amount of alarms for small oscillations in the monitored variable.

'DeadBandAlarm1' properties (DB.DeadBandAlarmSource)

Item | Source | Formatting | Links | **Dead band**

Setpoint:

☒ DB:

Value: Message text: Severity: Need ACK: ☒

Delay (ms):

Return message:

Dead band tab

The available options on this tab are described on the next table.

Available options for Dead band tab

OPTION	DESCRIPTION
SetPoint	A Link to a reference variable, so that users can monitor a difference relative to a monitored variable.
DB	Enables a dead band, which is a feature used to avoid that a variable generates an unnecessary amount of messages when oscillating around an alarm limit.
Value	Indicates the difference between the monitored variable and the SetPoint, from which this alarm must be indicated. It must be informed in engineering units of the monitored variable.
Message Text	Allows specifying a text displayed to users when this alarm is in an active condition.
Severity	Specifies an alarm level's severity (it can be High , Medium , or Low).
Need ACK	Enables or disables alarm acknowledgment.
Delay (ms)	Specifies a delay time, in milliseconds. When this value is equal to 0 (zero, default), no delay is applied.
Return message	Allows specifying a text displayed to users when this alarm is not in an active condition.

13.3.4 Rate of Change

Used to monitor quick variations in a process variable. A **Rate of Change** Alarm Source uses its values specified in variable's units per second.

'ROCArm1' properties (DB.ROCArmSource)

Item | Source | User fields | Formatting | Links | **Rate of Change**

☒ ROC

Change/second: Message text: Severity: Need ACK: ☒

Delay (ms):

Return message:

Rate of Change tab

The available options on this tab are described on the next table.

Available options for Rate of Change tab

OPTION	DESCRIPTION
ROC	Enables verifying a Rate of Change alarm.
Change/second	Indicates the percentage of the monitored variable that can vary per second. This value is calculated based on each variable's reading interval, using the formula ROC = (Current Value - Previous Value) / (Current Instant - Previous Instant) . If this rate of change is greater than the specified rate, it is considered in an alarm status.
Message text	Allows specifying a text displayed to users when this alarm is in an active condition.
Severity	Specifies an alarm level's severity (it can be High , Medium , or Low).
Need ACK	Enables or disables alarm acknowledgment.
Delay (ms)	Specifies a delay time, in milliseconds. When this value is equal to 0 (zero, default), no delay is applied.

OPTION	DESCRIPTION
Return message	Allows specifying a text message displayed to users when this alarm returns to its normal status.

13.3.5 Discrete

Allows monitoring a variable by specifying multiple sub-conditions.

The screenshot shows the 'DiscreteAlarm1' properties dialog box with the 'Discrete' tab selected. The dialog contains a table with the following data:

Name	Enabled	Description	Value	Message text
Subcondition	<input checked="" type="checkbox"/>	Subcondition	Empty	
Subcondition2	<input checked="" type="checkbox"/>	Subcondition2	Empty	

Below the table, there is a 'Delay (ms):' field set to 0 and a 'Return message:' text box. At the top right of the dialog, there is a 'Map all subconditions' button.

Discrete tab

The available options on this tab are described on the next table.

Available options for Discrete tab

OPTION	DESCRIPTION
	Adds a new Sub-condition to this alarm.
	Removes the selected Sub-condition.
Map all subconditions	Allows mapping and syncing Alarm Sub-conditions from semantics available in the source object. This feature is currently supported only by Elipse Power server objects, therefore this button remains disabled by default in Elipse E3 .
Name	Sub-condition's name.
Enabled	Enables or disables this Sub-condition.
Description	Sub-condition's description.

OPTION	DESCRIPTION
Value	A value evaluated to determine whether this alarm occurs or not.
Message text	Message displayed when this Sub-condition is active.
Type	Sub-condition's behavior. It can assume values 0: Alarm , 1: Event , or 2: Return .
Severity	Sub-condition's severity type. It can assume values 0: High , 1: Medium , or 2 - Low .
Need Ack	Indicates whether this Sub-condition needs acknowledgment or not.
Delay (ms)	Specifies a delay time, in milliseconds. When this value is equal to 0 (zero, default), no delay is applied.
Return message	Allows specifying a text displayed to users when this alarm is not in an active condition.

13.4 Alarm Filter

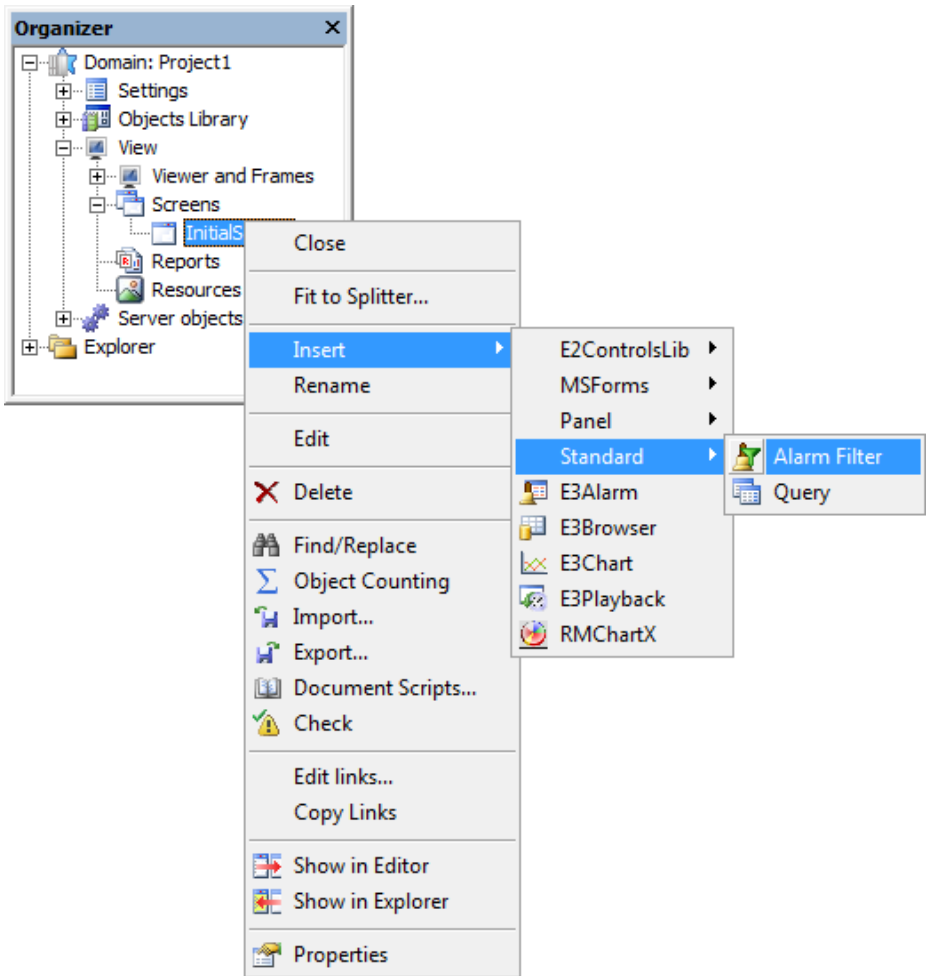
The **Alarm Filter** object allows specifying alarm filters just like an E3Alarm, except that it does not have a graphical representation that can be displayed on a Screen. Instead, the result of these filters can be consumed through several alarm counters or through the collection of events.

NOTES:

- The Alarm Filter object can be inserted on a Screen, on Viewer, on a Viewer Folder, or on a Data Folder.
- Alarms cannot be acknowledged using an Alarm Filter.

To insert this object on a Screen, for example, follow this procedure:

1. Right-click a Screen and select the **Insert - Standard - Alarm Filter** option.



Insert - Standard - Alarm Filter option

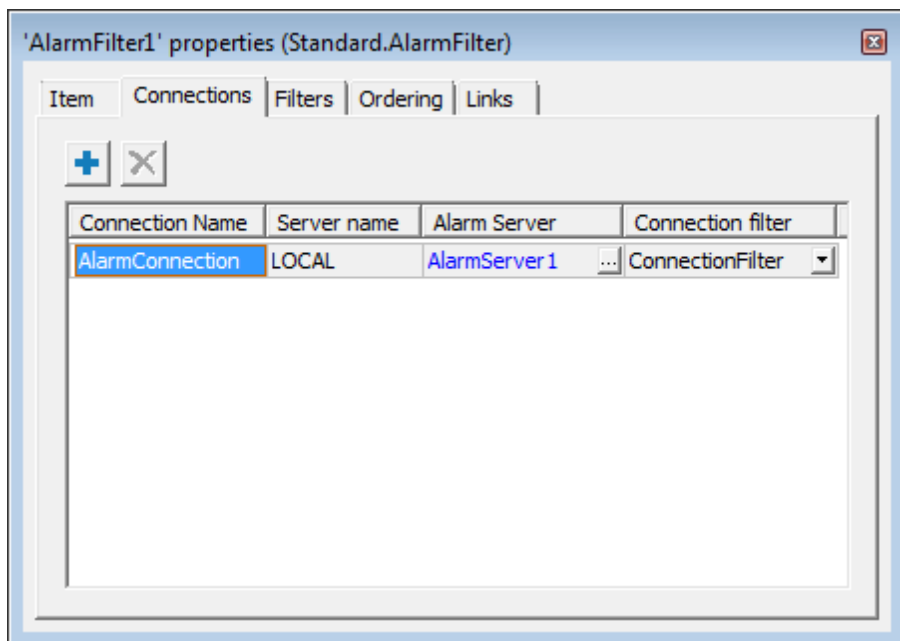
Some properties of this object can be configured on the Properties List, without creating scripts for this. If users need to configure a property, locate it on the Properties List and perform the necessary adjustments.

13.4.1 Configuration

To configure an Alarm Filter, right-click this object and select the **Properties** option.

13.4.1.1 Connections Tab

The **Connections** tab allows managing Alarm Filter connections with local or remote Alarm Servers.




Connections tab

The available options on this tab are described on the next table.

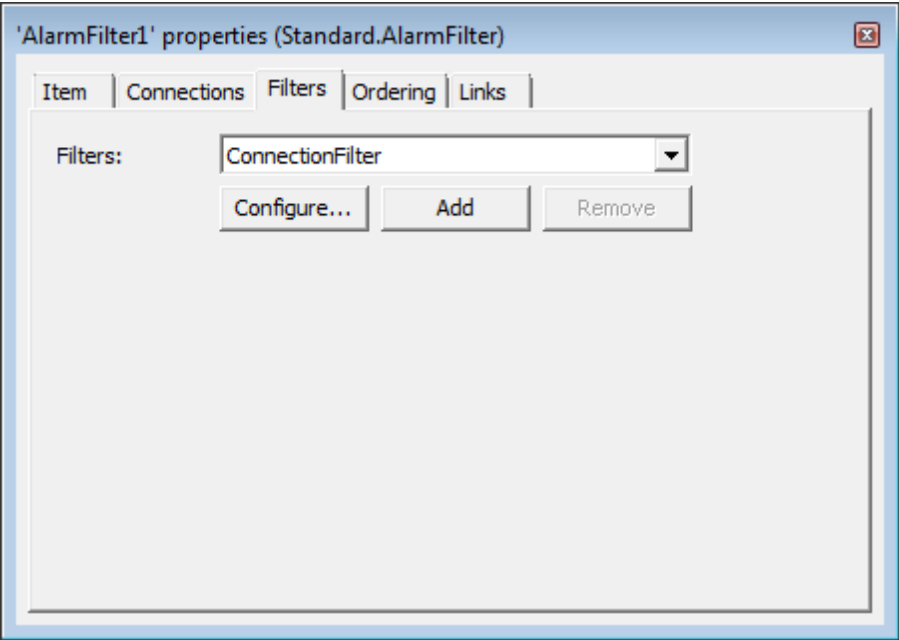
Available options on Connections tab

OPTION	DESCRIPTION
	Adds a new Connection to an Alarm Filter. This option corresponds to the Add method of the Collection of Connections.
	Removes the selected Connection. This option corresponds to the Remove method of the Collection of Connections. NOTE: The Connection created automatically with an object cannot be removed.
Connection Name	Name of this Connection. Press the F2 key to edit this name. This option corresponds to the ConnectionName property of a Connection object on the Collection of Connections.
Server name	Friendly name to identify a Domain from the selected Alarm Server. This option corresponds to the DomainName property of a Connection object on the Collection of Connections.

OPTION	DESCRIPTION
Alarm Server	Name of the Alarm Server, which can be a local Domain as well as a Remote Domain. This option corresponds to the AlarmServer property of a Connection object on the Collection of Connections. Click  to select an Alarm Server using AppBrowser.
Connection filter	Name of a Filter that contains the configuration of the alarm filter, defined on Filters tab. This option corresponds to the FilterConnection property of a Connection object on the Collection of Connections.

13.4.1.2 Filters Tab

The **Filters** tab allows managing filters from an Alarm Filter.



Filters tab

The available options on this tab are described on the next table.

Available options on Filters tab

OPTION	DESCRIPTION
Filters	Combo box with currently available Filters.

OPTION	DESCRIPTION
Configure	Opens a configuration window for the selected Filter, described next.
Add	Adds a new Filter to the Collection of Filters. This option corresponds to the Add method of the Collection of Filters.
Remove	Removes the selected Filter. This option corresponds to the Remove method of the Collection of Filters. NOTE: The Filter created automatically with an object cannot be removed.

When clicking **Configure**, the window on the next figure is opened to configure the selected Filter.

The screenshot shows a 'Filter properties' dialog box with a 'General' tab. The 'Name' field contains 'ConnectionFilter'. The 'Filter by Alarm Area' field is empty. The 'Filter by type' dropdown is set to 'Only alarms'. The 'Filter by severity' section has three checked checkboxes: 'High', 'Medium', and 'Low'. There is also a checked checkbox for 'Simple Area Filter' and an unchecked checkbox for 'Use custom filter'. At the bottom, there are 'OK', 'Cancel', and 'Apply' buttons.

Properties of the selected Filter

The available options on this window are described on the next table.

Available options on the properties window of a Filter

OPTION	DESCRIPTION
Name	Name of this Filter. This option corresponds to the FilterName property.
Filter by Alarm Area	Determines a filter by Alarm Area. If users want to use a filter, specify it in this field or leave it blank. This option is equivalent to the AreaFilter property.
Simple Area Filter	If the Filter by Alarm Area option is not blank, this option is enabled and, if selected, filtering by Area is based only on matching the initial part of a name. Otherwise, it considers the entire name of an Area. This option is equivalent to the SimpleAreaFilter property.
Use custom filter	Allows informing a custom filter for alarms. This option corresponds to the CustomFilter property.
Filter by type	Enables the type of filter applied to an alarm (Only alarms , Only events , or Alarms and events). This option is equivalent to the FilterType property.
Filter by severity	Enables or disables viewing severity degrees (High, Medium, or Low). This option is equivalent to the ShowHightPriority (High), ShowMediumPriority (Medium) e ShowLowPriority (Low) properties.

13.4.1.3 Sorting Tab

The **Sorting** tab allows configuring the default sort order of alarms. When more than one sorting field is used, the subsequent fields allow sorting among alarms that have the same value(s) for the previous field(s).

'AlarmFilter1' properties (Standard.AlarmFilter)

Item | Connections | Filters | **Ordering** | Links

Sort alarms:

☒ By field: DateTime (in) Descending

☐ Then by: Aked Descending

☐ Then by: Aked Descending

☐ Then by: Aked Descending

Sorting tab


The available options on this tab are described on the next table.

Available options on Sorting tab

OPTION	DESCRIPTION
By field	Sorts the alarms according to the specified field. This option is equivalent to the PrimarySortField property. Default sort order is performed using the InTime field, in descending order.
Then by	Sorts the alarms starting at the item specified in the By field option. The next item is sorted based on the specification indicated in Then by fields. These options are equivalent to the SecondarySortField , ThirdSortField , and FourthSortField properties, respectively.
Ascending	Sorts the alarm fields in ascending order. These options are equivalent to the PrimarySortAscending , SecondarySortAscending , ThirdSortAscending , and FourthSortAscending properties set to True, respectively.


OPTION	DESCRIPTION
Descending	Sorts the alarm fields in descending order. These options are equivalent to the PrimarySortAscending , SecondarySortAscending , ThirdSortAscending , and FourthSortAscending properties set to False , respectively.

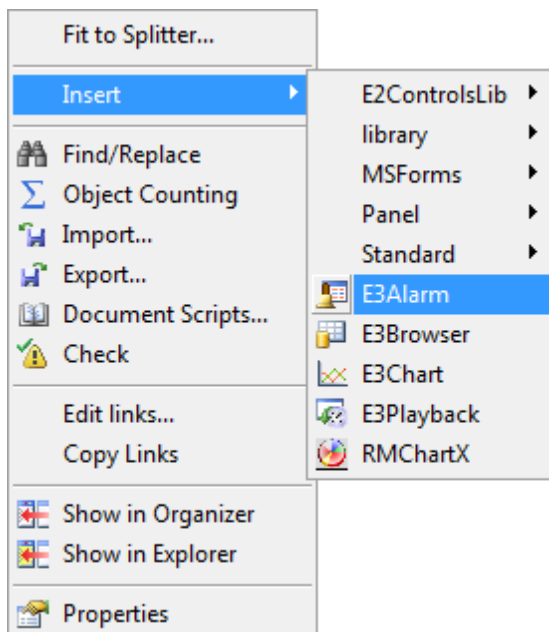
An **E3Alarm** monitors active or unacknowledged alarms in an application. With this object, users can check the status of alarms, as well as acknowledge them manually.

Ac...	Source Domain	Severity	Source name	Source name (full)	Condition Name
 No	Local	Medium	AlarmeAnalogico	Dados.TagDemo1...	Nível

E3Alarm

To use this object, follow this procedure:

1. Right-click a Screen or the working area and select the **Insert - E3Alarm** option, or click  **E3Alarm** on **Objects** toolbar.



Inserting an E3Alarm on a Screen

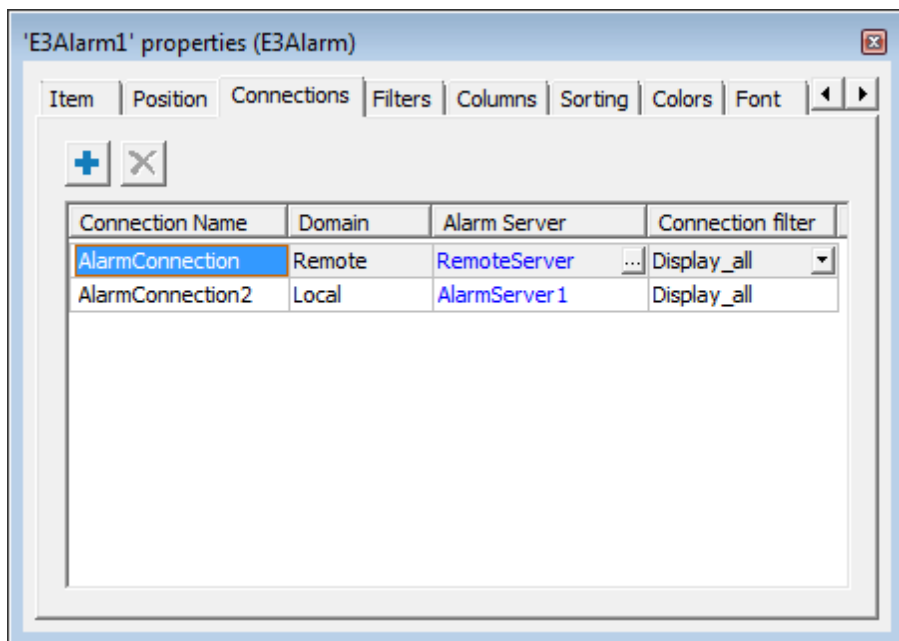
Some of this object's properties can be configured via Properties List, without creating scripts for this. To configure any property, just locate it on the Properties List and perform the necessary adjustments.

14.1 Settings

To configure an E3Alarm, right-click this object and select the **Properties** option.

14.1.1 Connections Tab



The Connections tab allows configuring one or more connections to local or remote Alarm Servers.




Connections tab

The available options on this tab are described on the next table.

Available options on Connections tab

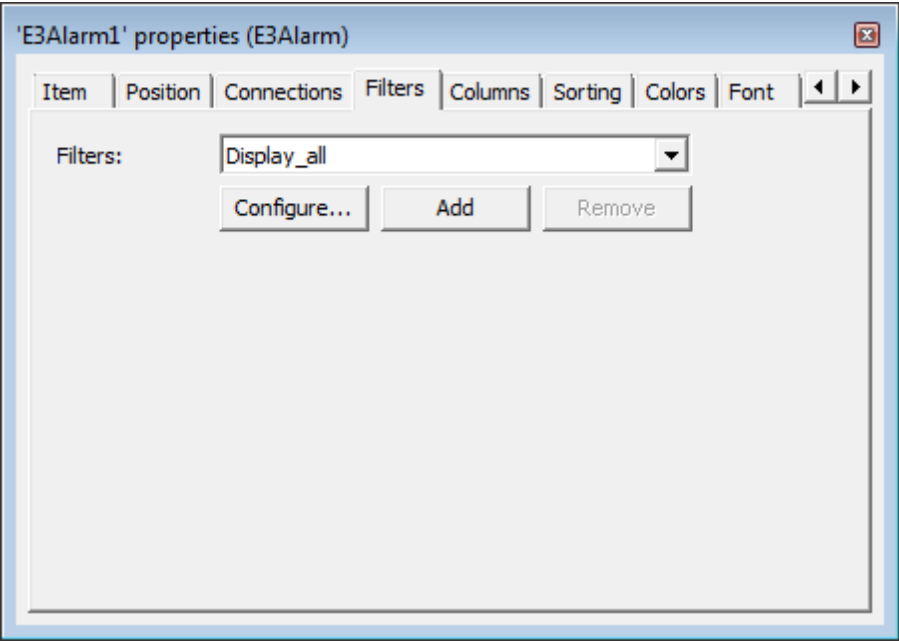
OPTION	DESCRIPTION
	Adds a new Connection to an E3Alarm. This option corresponds to the Add method of the Collection of Connections.
	Removes the selected Connection. This option corresponds to the Remove method of the Collection of Connections. NOTE: The Connection created automatically with an E3Alarm cannot be removed.
Connection Name	Name of this Connection. Press the F2 key to edit this name. This option corresponds to Connection's ConnectionName property on the Collection of Connections.
Domain	Friendly name to identify the Domain of the selected Alarm Server. This option corresponds to Connection's DomainName property on the Collection of Connections.

OPTION	DESCRIPTION
Alarm Server	Name of an Alarm Server, which can be on a local Domain as well as on a remote Domain. This option corresponds to Connection's AlarmServer property on the Collection of Connections. Click  to select an Alarm Server using AppBrowser.
Connection filter	Name of a Filter that contains settings for alarm filters, defined on Filters tab. This option corresponds to Connection's FilterConnection property on the Collection of Connections.

Users can access a remote Alarm Server by simply filling Connection's **AlarmServer** property of E3Alarm's Collection of Connections with data for remote Domain and Alarm Server, in the format **DOMAIN:SERVER**, where **SERVER** is the name of the remote Alarm Server and **DOMAIN** is the name of a Remote Domain that contains it. To configure a Remote Domain, please check topic **Remote Domain** on the chapter about **Domains**.

14.1.2 Filters Tab

The **Filters** tab allows managing E3Alarm filters.



Filters tab

The available options on this tab are described on the next table.

Available options on Filters tab

OPTION	DESCRIPTION
Filters	Combo box with all currently available Filters.
Configure	Opens the configuration window for the selected Filter, described next.
Add	Adds a new Filter to the Collection of Filters. This option corresponds to the Add method of the Collection of Filters.
Remove	Removes the selected Filter. This option corresponds to the Remove method of the Collection of Filters. NOTE: The Filter created automatically with an E3Alarm cannot be removed.

When clicking **Configure**, the window on the next figure is opened to configure the selected Filter.

The screenshot shows a 'Filter properties' dialog box with a 'General' tab. The 'Name' field is 'Display_all'. The 'Filter by Alarm Area' field is empty. The 'Simple Area Filter' checkbox is checked. The 'Use custom filter' field is empty. The 'Filter by type' dropdown is set to 'Alarms and events'. The 'Filter by severity' section has three checked checkboxes: 'High', 'Medium', and 'Low'. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

Properties of the selected Filter

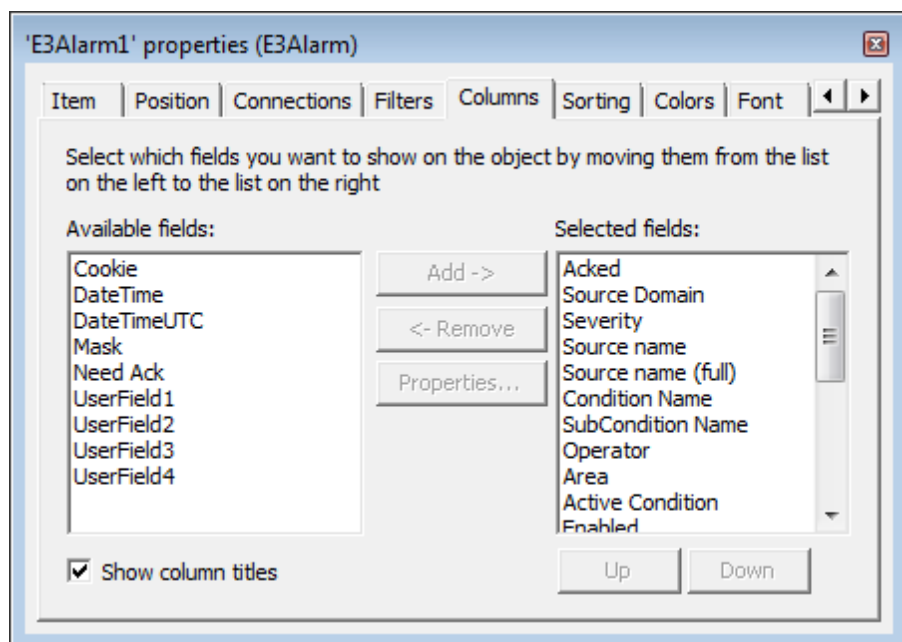
The available options on this window are described on the next table.

Available options on the properties window of a Filter

OPTION	DESCRIPTION
Name	Name of this Filter. This option corresponds to the FilterName property.
Filter by Alarm Area	Determines a filter by Alarm Area. If users want to use a filter, specify it in this field, or leave it blank. This option is equivalent to the AreaFilter property.
Simple Area Filter	If the Filter by Alarm Area is not blank, this option is enabled and, if selected, filtering by Area is based on matching the initial part of a name. Otherwise, considers the Area's full name. This option is equivalent to the SimpleAreaFilter property.
Use custom filter	Allows informing a custom filter for alarms. This option corresponds to the CustomFilter property.
Filter by type	Enables the type of filter applied to an alarm (Only alarms , Only events , or Alarms and Events). This option is equivalent to the FilterType property.
Filter by severity	Enables or disables viewing the severity degree (High , Medium , or Low). This option is equivalent to the ShowHightPriority (High), ShowMediumPriority (Medium), and ShowLowPriority (Low) properties.

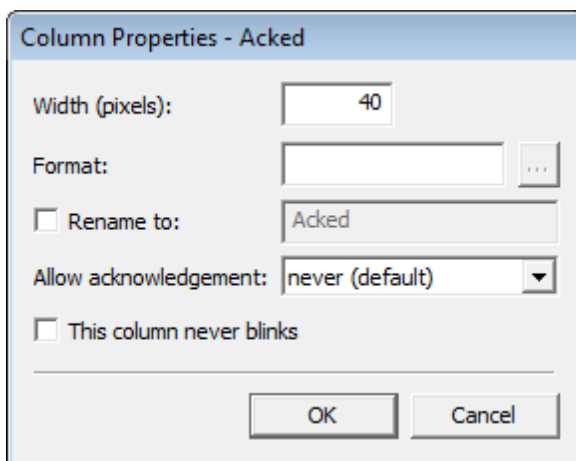
14.1.3 Columns Tab

On **Columns** tab, users can select fields to view on an E3Alarm. Fields displayed in **Available Fields** and **Selected Fields** items are generated by an Alarm Server. For more information, please check the **Alarm Fields** table on topic **Configurations for Alarm Table Generation of Alarms** chapter.



Columns tab


The **Available Fields** list displays all Alarm Source fields. By clicking **Add**, users can add each field individually to this E3Alarm. By clicking **Properties**, users can configure properties of this alarm field.



Column properties

The available options on this window are described on the next table.

Available options for Column Properties window

OPTION	DESCRIPTION
Width (pixels)	Specifies column's width, in pixels. Default width of E3Alarm's columns is 80 pixels
Format	Specifies a format used by this E3Alarm's column. E3's default format is used here (please check topic Value Format), except for Severity , Active Condition , Need Ack , Acknowledged , and Enabled fields, whose format examples can be seen on the next tables
Rename to	Renames this column's title
Allow acknowledgement	Configures alarm acknowledgment when users click a configured column's row. The available options are: <ul style="list-style-type: none"> • Never: This alarm is not acknowledged (default) • On click: This alarm is acknowledged when users click a configured column's row • On double-click: This alarm is acknowledged when users double-click a configured column's row NOTE : If this alarm can be acknowledged, mouse pointer then changes to  at run time, whenever it is over an unacknowledged alarm row
This column never blinks	Enables or disables a column-blinking effect

Format for Severity field

DATA	FORMAT	FORMATTED OUTPUT
High Severity	;;;	High
Medium Severity	"H","M","L"	M
Low Severity	;;;	Low

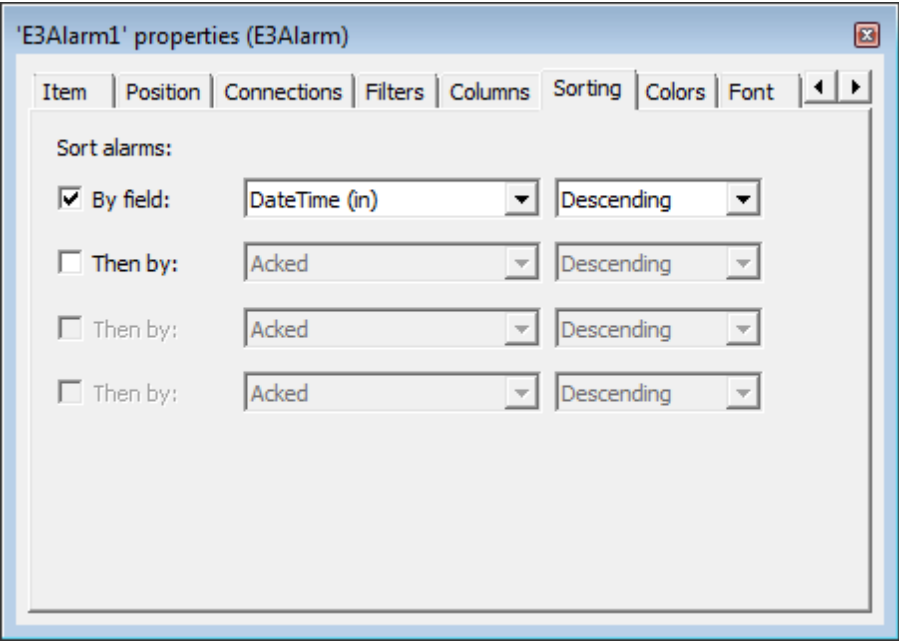
Format for Active Condition, Need Ack, Acknowledged, and Enabled Fields

DATA	FORMAT	FORMATTED OUTPUT
True	"OK"; "Not OK"	OK
False	"OK"; "Not OK"	Not OK
True	"AAA"	AAA
False	"AAA"	No
True	;	Yes
False	;	No

To remove any unwanted field, select it and click **Remove**.

14.1.4 Sorting Tab

On **Sorting** tab, users can configure default alarm's sort order. When using more than one sort field, subsequent fields allow a sort order among alarms whose value is the same for the previous field(s).



Sorting Tab

Each field on the **Sorting** tab has a corresponding property. The available properties are described on the next table.

Available options for Sorting tab

OPTION	DESCRIPTION
By field	Sorts alarms according to a specified field. This field is equivalent to the PrimarySortField property.
Then by	Sorts alarms starting at the item specified in the By field option. The next item is then sorted as specified in the Then by fields. These fields are equivalent to the SecondarySortField , ThirdSortField , and FourthSortField properties, respectively.

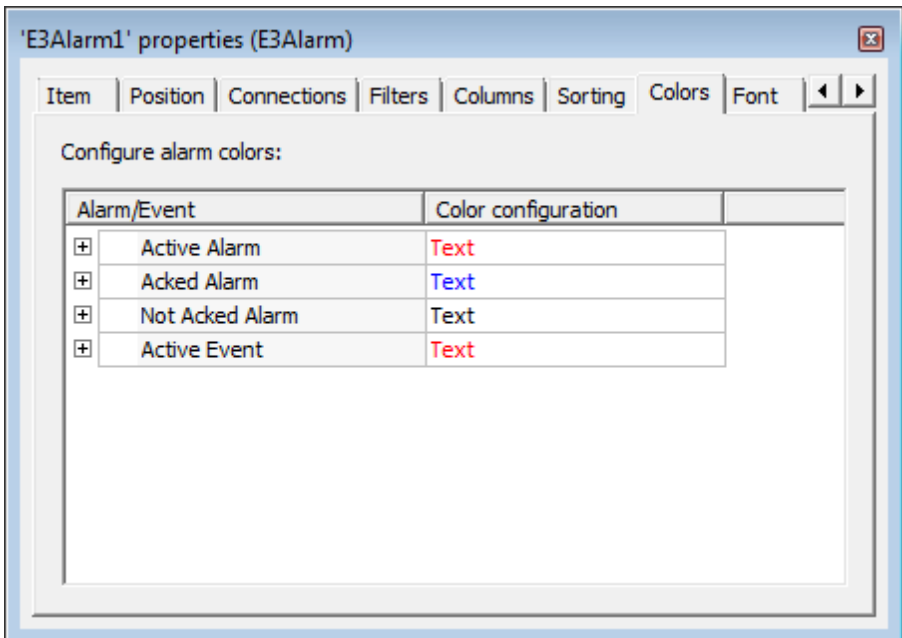
OPTION	DESCRIPTION
Ascending	Sorts alarm fields in ascending order. These fields are equivalent to the PrimarySortAscending , SecondarySortAscending , ThirdSortAscending , and FourthSortAscending properties set to True, respectively.
Descending	Sorts alarm fields in descending order. These fields are equivalent to the PrimarySortAscending , SecondarySortAscending , ThirdSortAscending , and FourthSortAscending properties set to False, respectively.

NOTES:


- Default sort order is performed by the **InTime** field, in descending order.
- If the **BannerMode** property is set to True, the displayed alarm depends on the sort configuration performed on this tab.

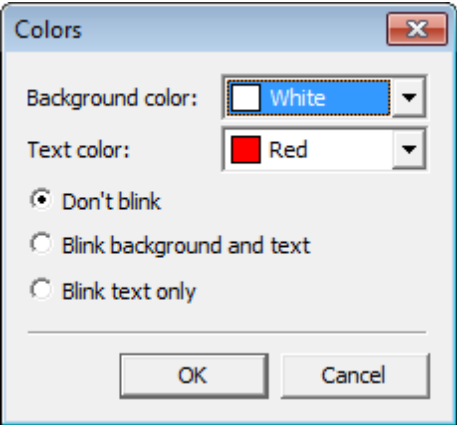
14.1.5 Colors Tab

On **Colors** tab, users can define colors for acknowledging alarms on this object. Users can configure colors for each alarm type or by severity.



Colors tab

Click  to select a color for the selected alarm type. The window on the next table is then displayed.



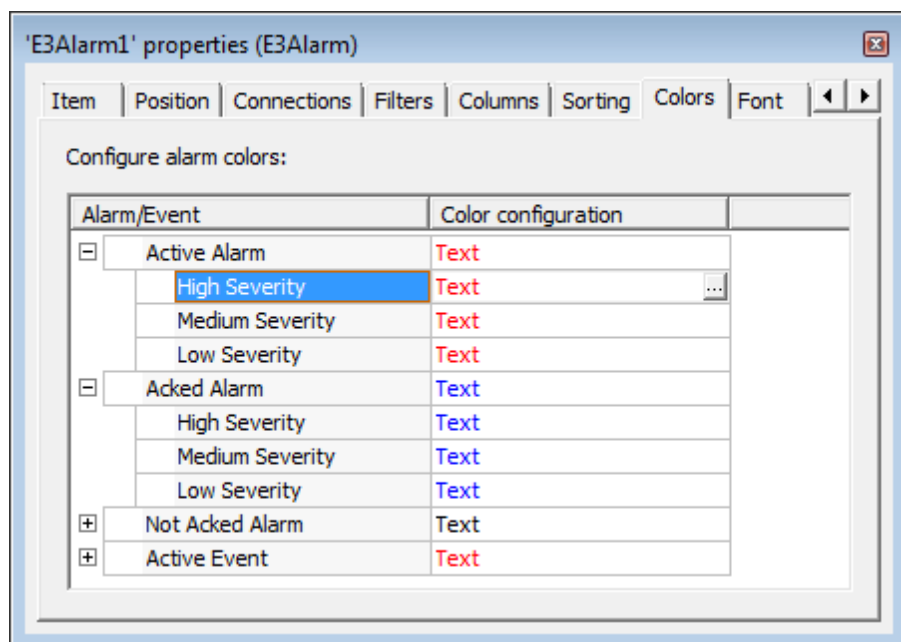
Selected alarm colors

The available options on this window are described on the next table.


Available options on Colors window

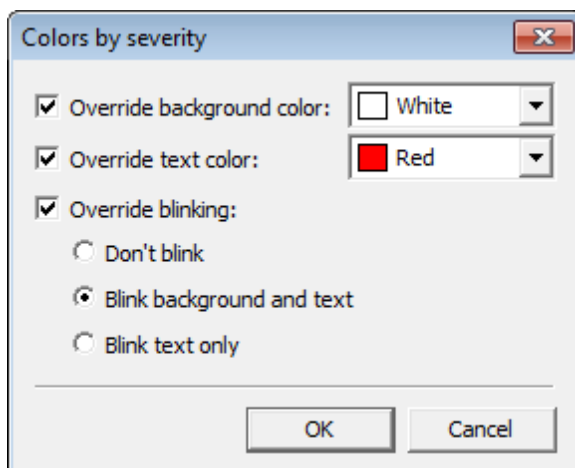
OPTION	DESCRIPTION
Background color	Specifies this alarm's background color
Text color	Specifies this alarm's text color
Don't blink	When selected, this alarm's text does not blink
Blink background and text	When selected, text and background colors alternate
Blink text only	When selected, text color alternates between selected text and background colors

Users can also select colors by severity, for each alarm type.



Alarm colors by severity

Click  to redefine colors for only one type of severity, for the selected alarm type. The window on the next figure is then displayed.



Colors by severity

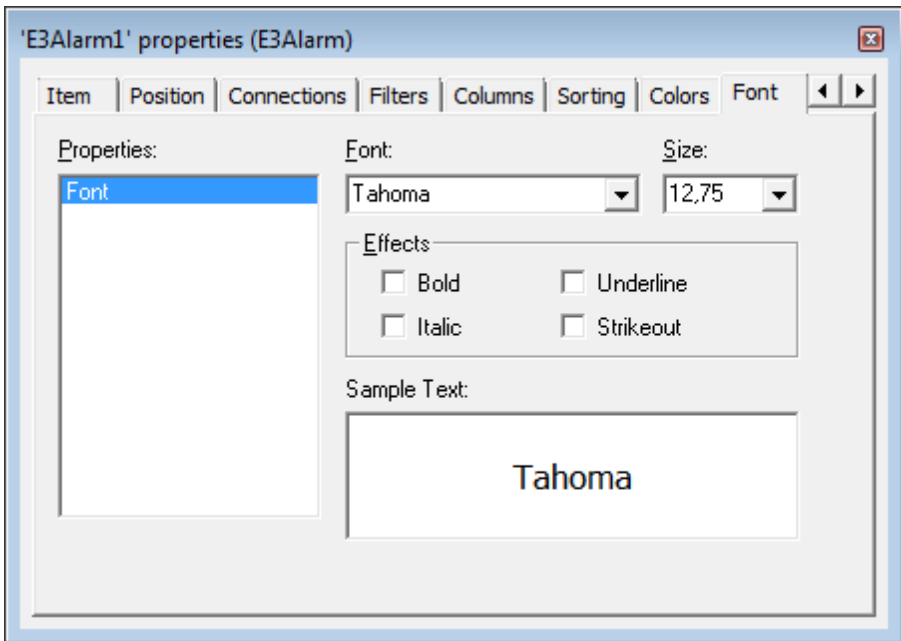
The available options on this window are described on the next table.

Available options for Colors by severity window

OPTION	DESCRIPTION
Override background color	Determines alarm's background color only for the selected severity. If this option is not selected, the selected color in the Background color option of the selected alarm type remains active.
Override text color	Determines alarm's text color only for the selected severity. If this option is not selected, the selected color in the Text color option of the selected alarm type remains active.
Override blinking	Redefines a blinking option for alarm text and background for the selected severity. If this option is not selected, the selected option in the selected alarm type remains active.

14.1.6 Font Tab

On **Font** tab, users can configure a font for E3Alarm's header and rows.



Font tab

The available options refer to font type, size, and effects.




NOTE: This tab's name appears in the configured Windows language, and not necessarily in E3's current language.

14.2 Runtime Behavior

An E3Alarm has a series of features that only apply at run time. These features are explained on the next topics.

14.2.1 Viewing Alarms

At run time, system alarms can be viewed on an E3Alarm.

Ack...	Operator	Area	Condition Name	Active Condition	Enabled	Ca
 No		Area1	Level	No	Yes	Lev
 No		Area1	Digital	Yes	Yes	Dig
 No		Area1	RateOfChange	Yes	Yes	Rat

E3Alarm at run time

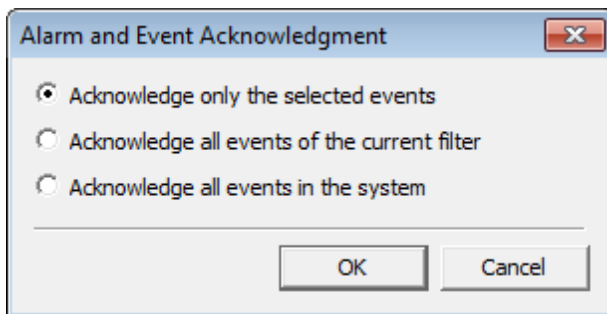
Among the alarms that meet the configured filters, active or unacknowledged ones are displayed on an E3Alarm. Usually, these alarms can be divided in two cases:

- If Alarm Source's **Need Ack** option is set to False, this alarm is considered acknowledged since its activation, with no need to acknowledge it. In this case, this alarm is visible until it leaves its active condition
- If Alarm Source's **Need Ack** option is set to True, users can acknowledge this alarm either before or after its variable leaves this alarm's condition. In both cases, this alarm only leaves E3Alarm list when both conditions are met

The **BannerMode** property, when set to True, allows viewing only a single alarm message on an E3Alarm object. The displayed message depends on the configuration performed on **Sorting** tab.

14.2.2 Alarm Acknowledgement

In its default configuration, whenever users right-click an E3Alarm, a contextual menu with the **Acknowledgment** option is then displayed. By selecting this option, the dialog box on the next figure is displayed.



Alarm acknowledgment options

The available options on this dialog box are displayed on the next table.

Available options for Alarm and Event Acknowledgment dialog box

OPTION	DESCRIPTION
Acknowledge only the selected events	Only selected alarms are acknowledged
Acknowledge all events of the current filter	All visible alarms on this E3Alarm are acknowledged
Acknowledge all events in the system	All alarms in a Domain are acknowledged

- The **Acknowledge only selected events** option is only available if there are alarms selected on this E3Alarm. Users can acknowledge this alarm (in this case, a new record is inserted on the Database indicating this acknowledgment), and the corresponding row on this E3Alarm indicates that it was acknowledged. This option is disabled if the **AllowAckSelected** property is set to False
- The **Acknowledge all events of the current filter** option is only available if there are visible alarms on this E3Alarm. Users can select this option without clicking any alarm. To do so, click any area on this E3Alarm and the Acknowledgment window is then displayed. When clicking it, the acknowledgment dialog box appears. This option is disabled if the **AllowAckCurrentFilter** property is set to False
- The **Acknowledge all events in the system** option is always available, even if there is no visible alarm on this E3Alarm. This option is disabled if the **AllowAckAll** property is set to False





Alarm acknowledgment can also be performed by clicking or double-clicking an alarm's row. To do so, specify in column properties (E3Alarm properties, **Columns** tab, **Properties** option) the way to acknowledge this alarm at run time, by clicking or double-clicking its column.

14.2.3 Column Sort Order

On default settings, users can sort alarms by clicking E3Alarm's column headers. When clicking the desired column's header, the associated field is then configured as its primary sort field. When clicking it again, its primary sort field (ascending or descending) is then reversed.

When clicking the desired column's header with the SHIFT key pressed, its associated field is then configured as its secondary sort field. When clicking it again with the SHIFT key pressed, its secondary sort field is then reversed.

For more information about this behavior, please check E3Alarm's **PrimarySortAscending**, **PrimarySortField**, **SecondarySortAscending**, **SecondarySortField**, **ThirdSortAscending**, **ThirdSortField**, **FourthSortAscending**, **FourthSortField**, and **BannerMode** properties on the **Scripts Reference Manual**.



DateTime (in)	Area	Message	Category	Acked
 08/01/2013 01:25:22 PM	DemoTag4 Area	Returns 4	Level	No
 08/01/2013 01:25:22 PM	DemoTag3 Area	Returns 3	Level	No
 08/01/2013 01:25:22 PM	DemoTag2 Area	Returns 2	Level	No
 08/01/2013 01:25:22 PM	DemoTag1 Area	Returns 1	Level	No

Sorting example

On the previous figure, alarms are first sorted by **DateTime (in)** in descending order, and then by **Area**, also in descending order.

14.2.4 Status of Connections




Starting on version 4.7, E3Alarm allows viewing the status of connections configured on **Connections** tab. To enable the status bar, configure E3Alarm's **ShowConnectionStatusBar** property on Properties List. The next figure displays the status bar enabled.

Ac...	Source Domain	Severity	Source name	Source name (full)	Active Condition
 No	Local	Low	AnalogAlarm	Data.DemoTag1....	Yes
 No	REMOTE	Low	AnalogAlarm	Data.DemoTag1....	Yes

AlarmConnection3: Connected

E3Alarm's status bar for connections

The following E3Alarm properties can be configured to control the behavior of this status bar:

- **ShowConnectionStatusBar:** Displays or hides the status bar
- **ConnectionStatusBarColor:** Specifies a background color for the status bar
- **PictureConnected:** Path to an image file with an icon representing a successful connection. Default for E3Alarm is displaying the icon 
- **PictureNotConnected:** Path to an image file with an icon representing a failed connection. Default for E3Alarm is displaying the icon 
- **PictureUnknown:** Path to an image file with an icon representing an unknown connection. Default for E3Alarm is displaying the icon 

NOTE: The unknown status indicates that an E3Alarm did not receive a confirmation from the Alarm Server that this connection was successful. This is the default status for versions earlier than 4.7.

A **Storage** is an alternative module for historic data recording. With this module, users can transform production data, processes, and other collections into management information. This module allows a great amount of information to be collected via OPC servers, Elipse Drivers, databases in general, or even text files and data stored in commercial databases (Microsoft SQL Server and Oracle) by user-defined historic objects in a compact and efficient way.

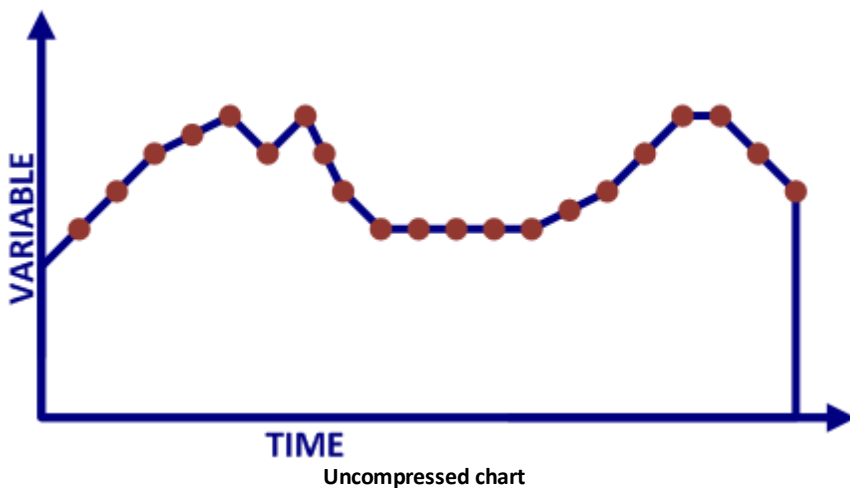
Information storage follows a logic that data is only stored when there is a significant, user-defined, variation. The analysis of these variations is performed by the **BoxCar/BackSlope** algorithm, which allows, depending on the configured dead bands, a significant data compression with full recovery of useful information.

Data recovering in E3 environment can be performed by a standard query tool, which allows users to graphically assemble a query structure (similar to Microsoft Access or SQL Server) or even editing SQL queries directly. Extracted data can be viewed as a table (E3Browser) or as a chart (E3Chart), or even as a report that can be viewed on screen (using Report's **PrintPreview** method), printed directly on paper, or exported to several different formats, such as Acrobat PDF, HTML, TXT, CSV, TIFF, and GIF, among others.

Storage's main function is to allow recording data in a compact way. With this tool, users can recover, with great accuracy, all changes in process variables, thus occupying less space on a database. Some examples are shown on next topics.

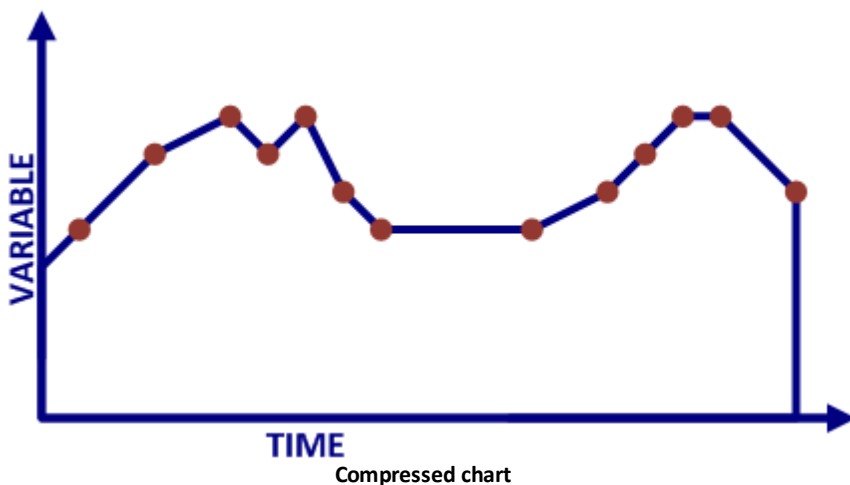
Uncompressed chart

Processed information contains several points.



Compressed chart

Information is virtually the same as the previous one, but with fewer points.

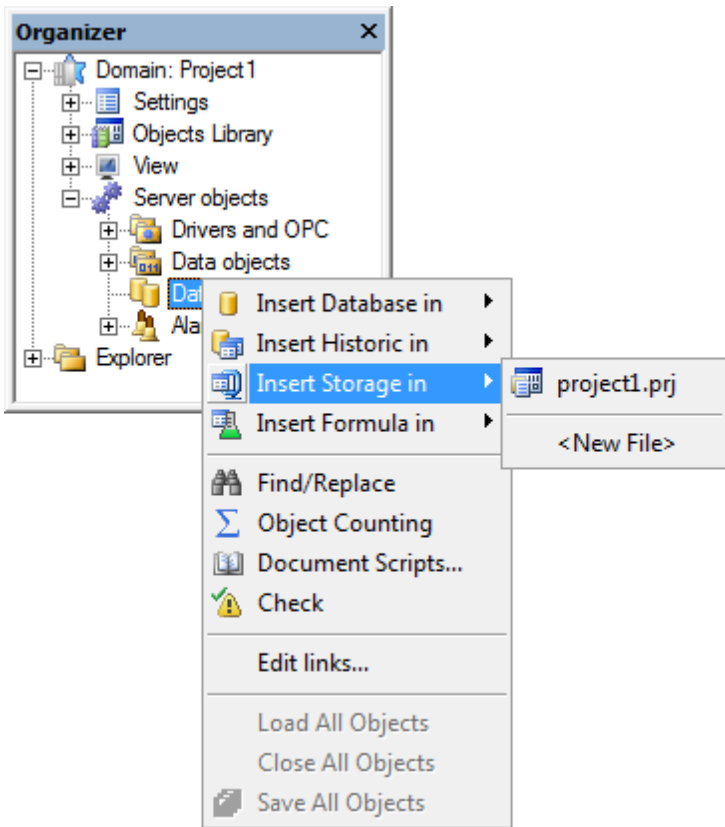


Storage recording is performed as follows:

- After defining a table in Storage properties, this table is generated by clicking **Create Table** and data is stored using these definitions. If a Tag quality varies, data is also stored
- Data is not stored if this variation occurs in a time interval smaller than the minimum programmed time interval (the **MinRecTime** field)

To insert this tool in E3, follow these procedures:

1. Right-click the project's name in **Explorer** mode and select the **Insert - Storage** option. In **Domain** mode, right-click the **Server objects - Databases** item, select the **Insert Storage in** option, and then the project's name.



Inserting a Storage in Domain mode

If necessary, configure object's properties. Some of its properties can be configured using the Properties List, without creating scripts for this. For more information, please check the **Scripts Reference Manual**.

NOTE: A Storage object can be configured to work as an **Alarm Area**.

15.1 Configuration

Whenever a Storage is created on a Screen, a list with record field definitions is then displayed.

Name	Source	Type	MinRec...	MaxRec...	Scan	De...	Unit
Field1	Data.DemoTag1.Value ...	0 - Double	0 ms	3600 s	0000 ms	1	0 - dbPercent
Field2	Data.DemoTag2.Value	0 - Double	0 ms	3600 s	0000 ms	1	0 - dbPercent
Field3	Data.DemoTag3.Value	0 - Double	0 ms	3600 s	0000 ms	1	0 - dbPercent
Field4	Data.DemoTag4.Value	0 - Double	0 ms	3600 s	0000 ms	1	0 - dbPercent

Fields configured for Storage





To add a field, users can drag and drop a Tag or property from Organizer, or else define a field and its source manually.

NOTE: Storage licenses are checked only when an application is executed and consider only active fields in that application, not the existing amount of fields on the database.

For further querying on data, every search is performed on the Tag path or on the property being stored, as defined in the **Source** field. The **Name** property is only used in case the **Source** field contains an expression (for example, **Driver1.Tag1 + Driver1.Tag2**).

So, if expressions are not used in the **Source** field, there is no need to care about a field's name. The available options are described on the next table.


Available options for Storage view

OPTION	DESCRIPTION
	Adds fields to a Storage table.
	Deletes the selected field from a Storage table.
	Determines Storage table configurations.
	Generates the structure on the Database.
Name	Determines the name of this field on a Storage table.
Source	Determines data source to link to this field.
Type	Determines this field type on a Storage table. If this column changes to Bit , Text , or Integer , the MinRecTime , MaxRecTime , Scan , Dead Band , and Unit columns are disabled.

OPTION	DESCRIPTION
MinRecTime	Minimum time for data insertion on a table. This field is calculated in milliseconds.
MaxRecTime	Maximum time for data insertion on a table, in seconds. If this time exceeds, data is considered old, and therefore stored.
Scan	Scan time of this field. If it is 0 (zero), this column is disabled and displays a value defined in MaxRecTime , in milliseconds.
Dead Band	Dead band to calculate the algorithm.
Unit	Absolute value or a percentage of modification.


15.1.1 Creating an Empty Storage

A Storage object can be created without configuring its fields. For this, just fill in the **DBServer** and **TableName** properties when creating it. This configuration allows creating a query-only Storage, which is very useful when accessing data generated by external applications. Some restrictions apply in this situation:

- Although a Storage is activated normally, it does not generate tables nor changes its indexes
- The **Create Table** option on Properties window, the **Create DB Structure** option of its contextual menu, and the  option on Storage's toolbar return an error message, indicating that a database structure cannot be created because there are no defined fields
- An empty Storage is usually listed on a Query's **Server Name** combo box
- There is no need for Storage licenses when querying external data, only for writing

15.2 Table Configuration

Users can access table configurations used in a Storage in two different ways:

1. By clicking **Properties** .
2. By right-clicking this object in Organizer and selecting the **Properties** option.

'Storage1' properties (DB.Historian)

Item | Alarms Area | **Storage** | Links

Database Server:

Table

Type database's table name (use this name later in queries).

Table name:

Discard

☐ Discard data from the main table

Discard data older than:

Perform discard every:

☐ Move discarded data to the backup table

Discard from backup data older than:

Database structure creation

Click the button to create Storage tables

Storage tab

Each field on **Storage** tab has a corresponding property. The available options on this tab are described on the next table.


Available options for Storage tab

OPTION	DESCRIPTION
Database Server	Defines a Database server. This field is equivalent to the DbServer property.
Table name	Defines a table name. This field is equivalent to the TableName property.
Discard data from the main table	Enables or disables discarding data from the main table. Data is considered old according to the Discard data older than option. This field is equivalent to the EnableDiscard property.

OPTION	DESCRIPTION
Discard data older than	Determines a time interval (minutes, hours, days, or months) during which data is kept on the main table. If data is older than the interval on this option, it is discarded. This field is equivalent to the DiscardInterval property and the field to select a time unit for this interval is equivalent to the DiscardTimeUnit property.
Perform discard every	Determines a discard interval (minutes, hours, days, or months) for old data on a table. This field is equivalent to the VerificationUnit property.
Move discarded data to the backup table	Enables or disables storing discarded data on the backup table. This field is equivalent to the EnableBackupTable property.
Discard from backup data older than	Determines a maximum time interval (minutes, hours, days, or months) for data on the backup table until it is discarded, regardless of the time data remains on the main table. For example, to keep data for 24 months on the main table and six more months on the backup table, this option's value must be 30 months. This interval must be longer than the one configured in the Discard data older than option of the main table. This field is equivalent to the BackupDiscardInterval property and the field to select a time unit for this interval is equivalent to the BackupDiscardTimeUnit property.
Create Table	Generates this table structure on the Database. This option is also available by right-clicking a Storage object in Organizer and selecting the Create DB Structure option.

After defining table configurations, click **Create Table**. This action creates a table structure on the database.

The table structure of a Storage is similar to a Historic table, with a table of definitions, a main data table, and a backup table (if selected). For users to identify externally that it is a compressed table, check if the **_Fields** table was created.

Storage_Fields 

☐ *

☐ FieldID

☐ FieldName

☐ FieldQuality

☐ FieldDescription

☐ FieldSource

☐ FieldType

☐ FieldEU

☐ FieldLowEng

☐ FieldHighEng

☐ FieldDeadBand

☐ FieldDeadBandUnit

☐ FieldMinRecTime

☐ FieldMaxRecTime

☐ FieldSize

☐ FieldVARTYPE

☐ FieldScanTimeMs

Fields table

This table contains the fields described next.

_Fields table fields

FIELD	DESCRIPTION
FieldDeadBand	Dead band.
FieldDeadBandUnit	Dead band unit. As a percentage of the previous value or as a percentage of engineering limits (a fixed value).
FieldDescription	Field's description.
FieldEU	Engineering unit.
FieldHighEng	Tag's higher limit.
FieldID	Index of a field registered on a Storage.
FieldLowEng	Tag's lower limit.
FieldMaxRecTime	When this time expires, data must be stored automatically.
FieldMinRecTime	Minimum variation time to store data.
FieldName	Field's name.
FieldQuality	Field's quality.
FieldScanTimeMs	Scan time that must be used to rebuild Tag's chart, in milliseconds.
FieldSize	Field's size.
FieldSource	Link used by this field to obtain its values.
FieldType	Field's type.
FieldVARTYPE	Field's native data type (0: Undefined, 3: Integer, 5: Double, 8: Text, or 11: Bit).

Storage implementation allows users to not worry about how data is stored on tables. However, for a better understanding on how this module works, and also to allow access to other programs, table format is explained next.

Options for table management described in the previous item actually apply to three table sets generated by a Storage, according to the **Table Name** field.

This happens because, for every type of stored magnitude, a set of tables is automatically generated: a set for analog Tags, another one for texts, and one more set for digital Tags. This way, every Storage can manage up to seven tables, if users specify that three types of Tags must be stored:

- <TableName>_Fields
- <TableName>
- <TableName>_Text
- <TableName>_Bit
- <TableName>_Backup
- <TableName>_Text_Backup
- <TableName>_Dig_Backup

The **_Fields** table contains a description of fields to store, which usually store the same information defined in Storage's fields configuration, in addition to link an automatic index to each field. All other tables have a fixed format:

- **E3TimeStamp**: Field that stores date and time of a Tag variation. If the communication protocol supports sending time information, this field contains device's timestamp
- **Quality**: Contains information about point's quality (**Bad**, **Uncertain**, or **Good**), according to its usage inside E3 and also according to OPC standards
- **Index**: Creates a relationship between the stored field and its respective name stored on **_Fields** table
- **Value**: Stored value. For an analog table it is a **Double**-type field (a real number), for a digital table it is an **Integer**, and for a text table it is a variable-sized **NVARCHAR** field, as specified in the **StringFieldSize** field

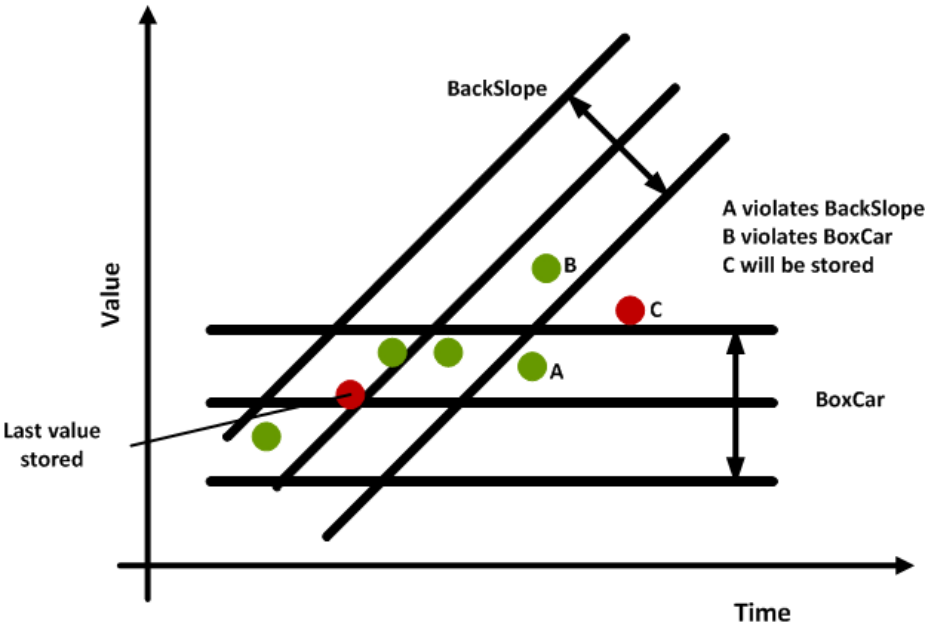
15.2.1 Execution

When starting the execution of an application and receiving the first value notification for each one of the stored variables, a Storage stores this value obtained with **Bad** quality, and right after that with the sent quality, if it is **Good**. This occurs because when performing a query, users view that an interruption in

Storage happened.

After that, as new values are obtained for variables, an algorithm for record checking interprets this sequence and decides whether each point must be stored or not. This algorithm, known as **BoxCar/BackSlope**, creates two variation bands (whose amplitude is given by this variable's dead band) of a stored point. The horizontal band (**BoxCar**) defines a common dead band verification. A second diagonal band (**BackSlope**) defines a variation upwards or downwards the dead band.

Therefore, if this variable is in a descending or ascending continuous derivative, it is only necessary to store the initial and final points on this straight line. So, an analog variable is only recorded if its value violates both horizontal and diagonal bands, or if there has been a quality change, that is, this device has been turned on or off.



Example of a BoxCar/BackSlope algorithm

This verification, however, only occurs for analog fields. For digital and text fields it is only necessary a simple change in value or in quality, such as a loss of communication, to store them.

15.2.2 Internal Query Tools

A **Query** tool provides an easy way to perform queries in Storage data.

When users start configuring a Query in an application that has a Storage, this object is added to the list of available Databases for queries. This is because

Storage acts as a new data provider, making it easy for users to search for data on temporal tables.

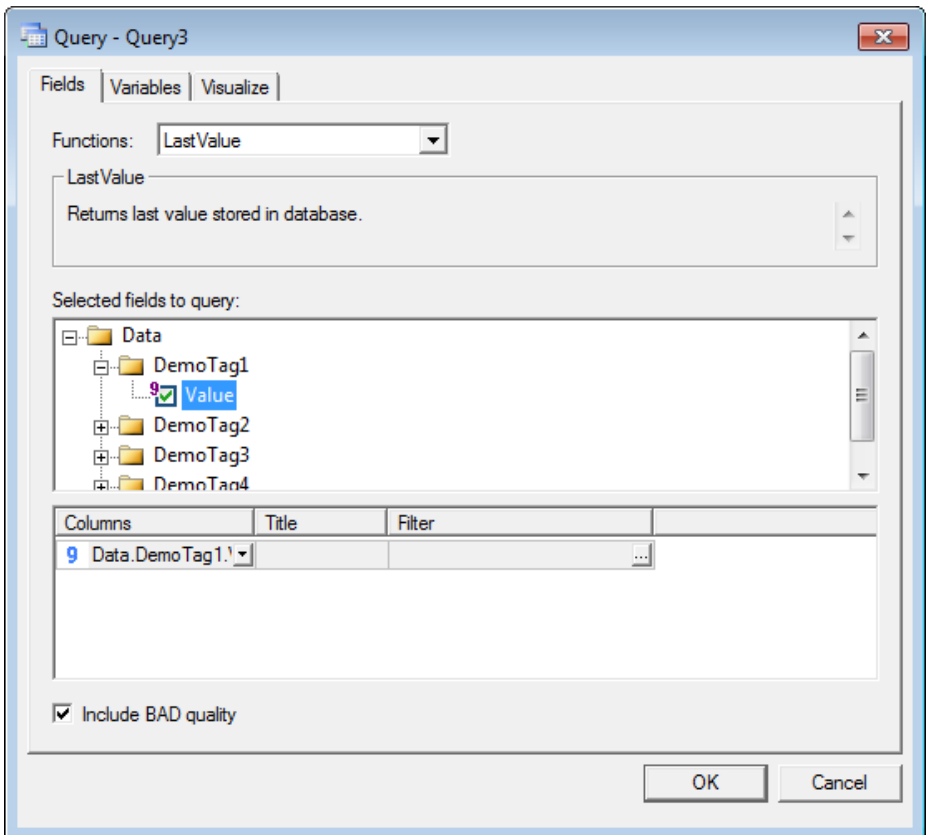
However, users can also perform queries directly on the original Database, according to table formats previously mentioned. The disadvantage of this procedure is that this query process is more complex.

Therefore, once a Storage is selected as a data provider for a Query, its configuration interface presents several differences, as seen on the next figure. The first one is that instead of displaying all tables, there is a tree with all stored variables. Another difference is that users can select from seven different functions for data consolidation:

- **LastValue**: Returns the last stored value on a Database
- **ArchivedValue**: Returns a stored value relative to a given point in time defined by the *TimeStamp* variable. The type of relationship, defined by the **FunctionSubType** property, can be **Previous** (A value stored immediately before a timestamp), **Next** (A value stored immediately after a timestamp), **Interpolated** (A calculated value based on previous and next values), and **ExactTime** (If a stored value is found in the exact instant provided by a timestamp). These variables can also be defined at run time, by calling Query's **SetVariableValue** method
- **TagAttribute**: Returns a Tag attribute, defined by the **FunctionSubType**, which can be **FieldDescription** (Tag's meaning or description), **FieldSource** (path of the Tag being stored), **FieldType** (data type: **Double**, **Bit**, **String**, or **Integer**), **FieldEU** (engineering unit), **FieldLowEng** (lower limit), **FieldHighEng** (higher limit), **FieldDeadBand** (dead band for storage), **FieldDeadBandUnit** (dead band unit, whether in absolute values or percentage), **FieldMinRecTime** (minimum time for storage, variations smaller than this interval are discarded), or **FieldMaxRecTime** (maximum time for storage, a lack of variation in these intervals forces a storage)
- **CompressedDataNValues**: Returns, for a single Tag, *N* values defined by the *NumVals* variable, stored from an initial point in time, defined by the *StartTime* variable. These variables can also be defined at run time, by calling Query's **SetVariableValue** method
- **CompressedDataStartEndTime**: Returns, for a single Tag, stored values between intervals defined by the *StartTime* and *EndTime* variables. These variables can also be defined at run time, by calling Query's **SetVariableValue** method
- **SampledData**: Returns, for one or more Tags, interpolated (estimated) values between time points defined by the *StartTime* and *EndTime* variables, in fixed intervals defined by the *TimeInterval* variable. These variables can also be defined at run time, by calling Query's **SetVariableValue** method
- **CalculatedData**: Returns, for one or more Tags, the result of mathematical operations applied to data between time points defined by the *StartTime* and

EndTime variables, in fixed intervals defined by the *TimeInterval* variable. The types of calculations performed by this function are: **Total**, **Minimum**, **Maximum**, **Standard Deviation**, **Amplitude**, **Mean**, and **Median**. These variables can also be defined at run time, by calling Query's **SetVariableValue** method

For all these options, users can indicate whether data with **Bad** quality is included in its result or not, via the **Include BAD quality** check box, corresponding to the **IgnoreQuality** property of the Query linked to the Storage object.



Query functions

15.2.3 Usage

If the selected function has any filter, then it is necessary to inform a filter value before executing a Query, on the configuration dialog box (on **Visualize** tab) or via script, by using the **SetVariableValue** method. Example:

```
Set Chart = Screen.Item("E3Chart1")
Set Query = Chart.Item("Query1")
```

```

Query.SetVariableValue "StartTime", Chart.IniDate
Query.SetVariableValue "EndTime", Chart.EndDate
Query.SetVariableValue "TimeInterval", _
    rs.Fields("SampleInterval").Value
Chart.Queries.UpdateData

```

15.2.4 External Query Tools

When users are developing an external application using languages such as Java, Visual Basic, or C++ and they want to retrieve data stored by a Storage, then they can perform calls to **Stored Procedures**, created by a Storage on a Database. There are seven Stored Procedures, which correspond to some Query options, as described on the next table.

Available options for queries

QUERY FUNCTION	STORED PROCEDURE
LastValue	E3LastValue
ArchivedValue	E3Archive, E3ArchiveInterpolate
CompressedDataNValues	E3NCompData
CompressedDataStartEndTime	E3CompData
SampledData	E3SampledData
CalculatedData	E3CalculatedData

Stored Procedures that use **Date**-type parameters receive them as a **Float** number, instead of a **DateTime**. This increases E3 precision, because using a **DateTime** format allows a maximum precision of 3ms, while a **Float** type allows 1ms precision.

To pass parameters more easily, users can add a user function to a Database that converts **DateTime** values into **Float** values, according to the next example.

```

CREATE FUNCTION E3GETFLOATVALUE(@dDate datetime)
RETURNS FLOAT AS
BEGIN
    RETURN CAST(@dDate AS float)
END

```

There are some usage examples for these functions in the next topics.

15.2.4.1 E3LastValue

Returns the last value stored on a Database for a given Tag. Formal description is:

```

E3LastValue(
    @strTableName VARCHAR(100),
    @strFieldName VARCHAR(100),
    @strFilter     VARCHAR(500),
    @type          int,
    @bQuality      int)

```

Where:

- **@strTableName**: Table name
- **@strFieldName**: Field name
- **@strFilter**: Filter options for this value, if needed
- **@type**: Data type (**0: String**, **1: Bit or Integer**, or **2: Analog**)
- **@bQuality**: If not equal to 0 (zero), it only includes Tags with **Good** quality

Returns a single-row query, with **E3TimeStamp**, **Quality**, and **FieldValue** fields. Usage example:

```
EXECUTE E3LastValue 'TableXX',  
'Tag234', '', 2, 1
```

15.2.4.2 E3Archive

Returns a value stored relative to an instant, according to the **ArchivedValue** function. It is used for **Prev** (0), **Next** (2), and **ExactTime** (3) sub-types. Formal description is:

```
E3Archive(  
    @iSubType      int,  
    @strTableName  VARCHAR(100),  
    @dData         float,  
    @strFieldName  VARCHAR(100),  
    @strFilter     VARCHAR(500),  
    @type          int,  
    @bQuality      int)
```

Where:

- **@iSubType**: Function sub-type (**0: Previous**, **2: Next**, or **3: Exact instant**)
- **@Data**: Time instant for this search, in **Float** format

Returns a single-row query, with **E3TimeStamp**, **Quality**, and **FieldValue** fields. Usage example:

```
DECLARE @MyDate FLOAT  
SET @MyDate = dbo.E3GETFLOATVALUE('10-10-2005 12:00:00')  
EXECUTE E3Archive 0, 'STO22', @MyDate,  
'Data.DemoTag1', '', 2, 0
```

15.2.4.3 E3ArchiveInterpolate

Returns points immediately before and after an instant, according to the **ArchivedValue** function, but only for the **Interpolate** sub-type. Formal description is:


```
E3ArchiveInterpolate(
    @strTableName VARCHAR(100),
    @dData         float,
    @strFieldName  VARCHAR(100),
    @strFilter     VARCHAR(500),
    @type          int,
    @bQuality      int)
```

Where:

- **@dData**: Time instant for this search, in **Float** format

This query returns two rows, with **E3TimeStamp** and **FieldValue** fields. Usage example:

```
DECLARE @MyDate FLOAT
SET @MyDate = dbo.E3GETFLOATVALUE('10-10-2005 12:00:00')
EXECUTE E3ArchiveInterpolate 'ST022', @MyDate,
    'Data.DemoTag1', '', 2, 0
```

15.2.4.4 E3NCompData

Equivalent to the **CompressedDataNValues** function. Formal description is:

```
E3NCompData(
    @strTableName VARCHAR(100),
    @dData         float,
    @strFieldName  VARCHAR(100),
    @iNValues      int,
    @strFilter     VARCHAR(500),
    @strOrder      VARCHAR(100),
    @type          int,
    @bQuality      int)
```

Where:

- **@iNValues**: Amount of values needed
- **@strOrder**: Sorts this query by a field other than **TimeStamp**

This function returns the number of rows requested, if found, with the **E3TimeStamp**, **Quality**, and **FieldValue** fields. Usage example:

```
DECLARE @MyDate FLOAT
SET @MyDate = dbo.E3GETFLOATVALUE('10-10-2005 12:00:00')
EXECUTE E3NCompData 'ST022', @MyDate,
    'Data.DemoTag1', 20, '', '', 2, 0
```

15.2.4.5 E3CompData

Equivalent to the **CompressedDataStartEndTime** function. Formal description is:

```
E3CompData(  
    @strTableName VARCHAR(100),  
    @dStartData   float,  
    @dEndData     float,  
    @strFieldName VARCHAR(100),  
    @strFilter     VARCHAR(500),  
    @strOrder      VARCHAR(100),  
    @type          int,  
    @bQuality      int)
```

Where:

- **@dStartData**: Start date, in **Float** format
- **@dEndData**: Final date, in **Float** format
- **@strOrder**: Sorts this query by a field other than **TimeStamp**

This function returns the number of rows found within this interval, with the **E3TimeStamp**, **Quality**, and **FieldValue** fields. Usage example:

```
DECLARE @MyStartDate FLOAT  
DECLARE @MyEndDate  FLOAT  
SET @MyStartDate = dbo.E3GETFLOATVALUE('10-10-2005 12:00:00')  
SET @MyEndDate   = dbo.E3GETFLOATVALUE('10-10-2006 12:00:00')  
EXECUTE E3CompData 'ST022', @MyStartDate,  
    @MyEndDate, 'Data.DemoTag1', '', '', 2, 0
```

15.2.4.6 E3SampledData

Equivalent to the **SampledData** function. Formal description is:

```
E3SampledData(  
    @strTableName VARCHAR(100),  
    @iModMin       int,  
    @dStartDate    float,  
    @dEndDate      float,  
    @strFields     VARCHAR(1000),  
    @strWhere      VARCHAR(4000),  
    @type          int,  
    @bQuality      int)
```

Where:

- **@iModMin**: Interval in seconds to interpolate each value within this interval
- **@dStartData**: Start date, in **Float** format

- **@dEndDate**: End date, in **Float** format
- **@strFields**: List of fields

Usage example:

```
DECLARE @MyStartDate FLOAT
SET @MyStartDate = dbo.E3GETFLOATVALUE('10-10-2004 12:00:00')
DECLARE @MyEndDate FLOAT
SET @MyEndDate = dbo.E3GETFLOATVALUE('10-10-2006 12:00:00')
EXECUTE E3SampledData 'STOXX', 10,
    @MyStartDate, @MyEndDate, 'Data.DemoTag1', '', 2, 1
```

15.2.4.7 E3CalculatedData

Equivalent to the **CalculatedData** function. Formal description is:

```
E3CalculatedData(
    @iSubType      int,
    @strTableName  VARCHAR(100),
    @iModMin       int,
    @dStartDate    float,
    @dEndDate      float,
    @strFields      VARCHAR(1000),
    @strWhere       VARCHAR(4000),
    @type          int,
    @bQuality      int)
```

Where:

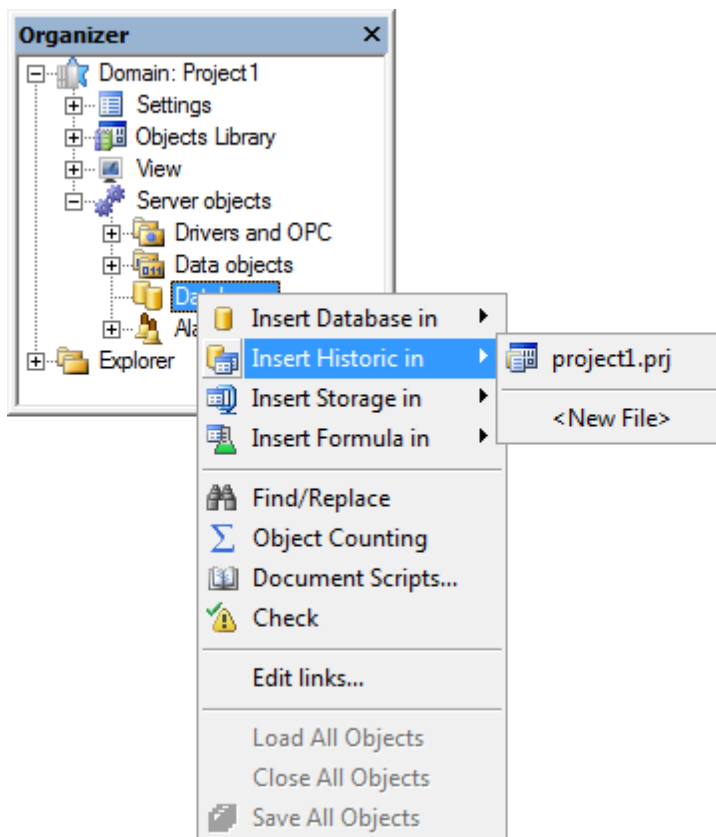
- **@iSubType**: Calculation sub-type (**0: Total, 1: Minimum, 2: Maximum, 3: Standard Deviation, 4: Amplitude, 5: Average, and 6: Median**)

Usage example:

```
DECLARE @MyStartDate FLOAT
SET @MyStartDate = dbo.E3GETFLOATVALUE('10-10-2004 12:00:00')
DECLARE @MyEndDate FLOAT
SET @MyEndDate = dbo.E3GETFLOATVALUE('10-10-2006 12:00:00')
EXECUTE E3CalculatedData 0, 'STOXX', 10,
    @MyStartDate, @MyEndDate, 'Data.DemoTag1', '', 2, 1
```

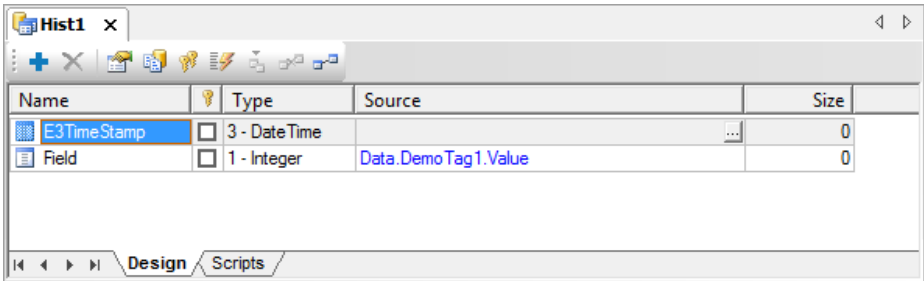
Historic objects are modules responsible for storing application data on a Database. They also store process data for future analysis. Users can create as many Historic files as needed, each one with different Tags or expressions. Each Historic can either create or use an independent table on a Database, whose storage may be defined by **Time** or by **Event**. By using the **CacheSize** property, users can define the number of records sent to a Database in a single operation. The **DBServer** property defines a Database Server that is used by a Historic object. To use this feature, follow these procedures:

1. Right-click the project's name in **Explorer** mode and select the **Insert - Historic** option. In **Domain** mode, right-click the **Server objects - Databases** item, select the **Insert Historic in** item, and then the project's name.



Inserting a Historic object in Domain mode










2. When a Historic object is enabled, the options on the next figure are displayed.



Historic object options

The available options on this view are described on the next table.

Available options for Historic view

OPTION	DESCRIPTION
	Adds fields to a Historic table.
	Removes the selected field from a Historic table.
	Specifies Historic table settings.
	Generates the structure in the Database.
	Creates a primary key.
	Configures the indexes to create in the Historic.
	Keeps a Historic object without a direct link to an existing table.
	Retrieves fields from the original table.
	Links the Historic object to an existing table.

3. Open Historic's properties window. To do so, right-click this object and select the **Properties** option. Some of this object's properties can be configured by using the Properties List, without creating scripts for this. To configure any property, locate it on the Properties List and perform the necessary adjustments. More information about this object's properties functionality can be found on **Scripts Reference Manual** on the chapter referring to Historic object.

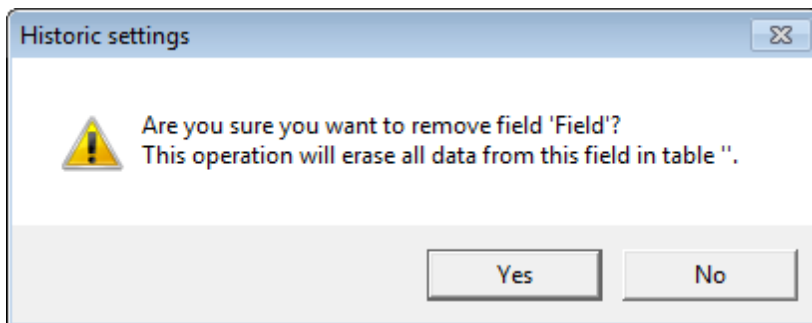
NOTE: A Historic object can be configured to work as an **Alarm Area**.

16.1 Settings

When inserting a Historic object in a project, the **E3TimeStamp** field is automatically created in a table. The **E3TimeStamp** field shows date and time in which this value was retrieved (unlike a Tag's timestamp). Remember that this is a read-only field. Users can link a Tag to an **E3TimeStamp** field. If there is no Link, it uses the system's current time for storage.

NOTE: Using system's current time to store the **E3TimeStamp** field is only available when the table is created by the Historic. In case of using an existing table, users must link a **Demo**-type Tag with its **Type** property configured as **3 - Current Time** so that this field stores the correct date and time.

To create a table in a Historic object, users must create its fields previously, by clicking **+ Add field**. To remove unwanted fields, click **✗ Remove fields**. The confirmation message of the next figure then appears.



Message to confirm field removal from a table

The **Name** field defines table's field name, the **Type** field defines table's field type, and the field's source is defined by the **Source** field. Users can also define whether this field is the table's primary key or not.

16.1.1 Primary Key



A **Primary Key** is either a field or a set of fields identifying each record of a table in a unique way. As in a table's main index, it is used to link data among tables. Primary keys can be client codes, registration numbers, etc. After defining a field as a table's primary key, the Database itself ensures that no duplicated data is inserted in a primary key field. For example, if users try to place an order with the same number of a pre-existing order, that record is not created and an error message is then displayed. There are two types of primary keys: **Simple** or **Compound**.

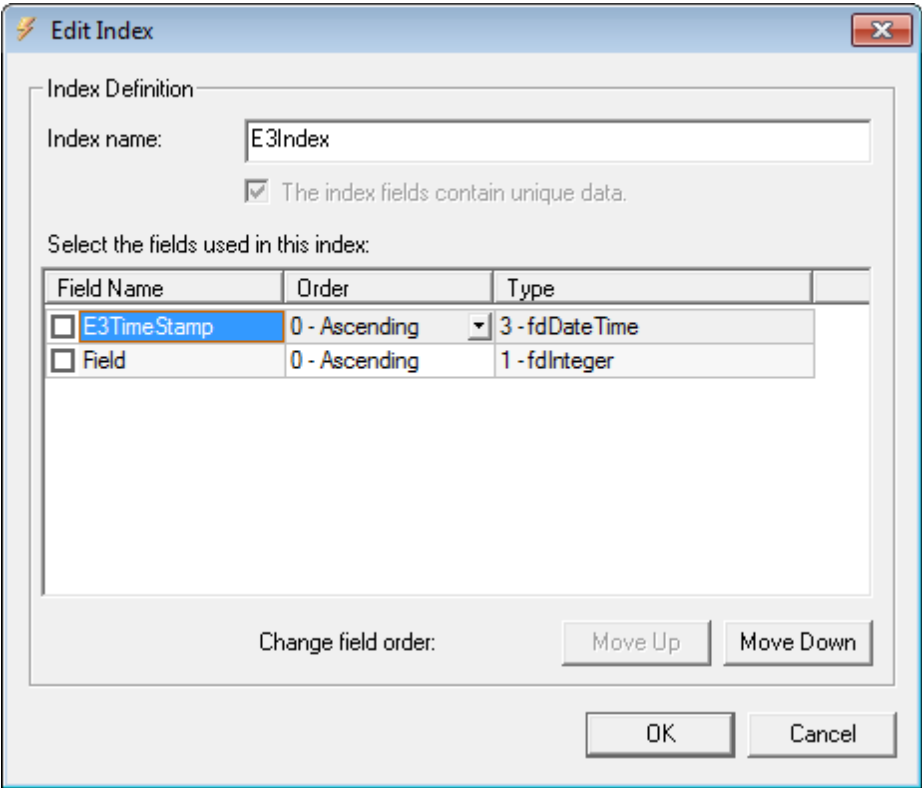
A **Simple primary key** is a field identifying each record of a table in a unique way. A **Compound primary key** can be formed by a combination of two or more fields in a

table. There can be situations when one single field cannot act as a primary key, because it has repeated values. In addition, a table can only have one primary key, be it simple or compound. That is, users cannot define two or more table fields so that each one is a separate primary key. However, this is not the case of a compound primary field, where two or more fields are combined to form a unique primary key.

When selecting fields for a Primary Key, consider the following details:

- Neither duplicated nor null values are allowed
- In case there is no unique identifier for a specific table, users can select a field that generates sequentially numbered records

Users can configure a primary key in two different ways: by checking on Historic object window which table field is the preferred primary key, and then enabling it by clicking  or by clicking , which opens a configuration window, according to the next figure.



Edit Index

Index Definition

Index name:

☒ The index fields contain unique data.

Select the fields used in this index:

Field Name	Order	Type
<input checked="" type="checkbox"/> E3TimeStamp	0 - Ascending	3 - fdDateTime
<input type="checkbox"/> Field	0 - Ascending	1 - fdInteger

Change field order:

Editing a Primary Key index

On this window, select a field as the primary key. The available options on this

window are described on the next table.

Available options for Edit Index window

OPTION	DESCRIPTION
Index name	Specifies a name for this primary key.
The index fields contain unique data	Ensures that values specified for this Primary Key index are unique. This option is always selected for Primary Keys, and it cannot be changed.
Field name	Shows field's name.
Order	Shows the selected field's sort order.
Type	Shows table's field type.
Change field order	Changes field's sort order on this table, by moving it up or down on this list.

By clicking **OK**, users confirm the specified field as a primary key. To cancel that configuration, click **Cancel**. Users can also assign an index to a table.


16.1.2 Indexes

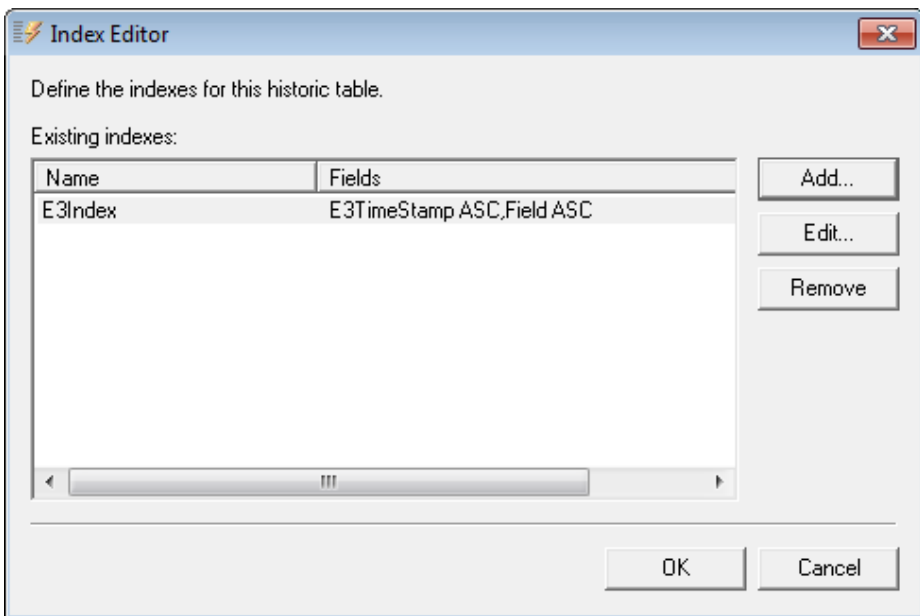
An **Index** is a field or sets of fields previously sorted by a Database, to improve the performance of queries that use this index. They are used to quickly find records with a specific value on a column. Without an index, a Database must start on the first record and then read the full table until relevant records are found. The larger the table, the higher the cost of this operation. If this table has an index for those columns, a Database can quickly get a position to search for in a data file without scanning all records. For example, if a table has 1,000 records, this is at least 100 times faster than reading all records sequentially. Notice that if there is a need to access almost all 1,000 records, it is faster to access them sequentially, avoiding disk access.

The available types for indexes are: **Primary**, **Unique**, and **Index**.

All column types on a table can be indexed. Using indexes on relevant columns is the best way to improve table performance. The maximum amount of indexes per table and the index's largest size is defined by the Database Server's storage device.

Users can create indexes on multiple columns. A multi-column index can be considered an ordered array with values created by concatenating values from indexed columns.

Indexes can be configured by clicking , which opens a configuration window, according to the next figure.



Index Editor window

The available options on this window are described on the next table.

Available options for Index Editor window

OPTION	DESCRIPTION
Name	Displays the name of an existing index.
Fields	Displays the field to which this index is linked on a table.
Add	Opens a dialog box to add a new index.
Edit	Opens a dialog box to edit the selected index.
Remove	Removes the selected index.

When clicking **Add**, the dialog box on the next figure is then opened.

Add Index

Index Definition

Index name:

☐ The index fields contain unique data.

Select the fields used in this index:

Field Name	Order	Type
<input type="checkbox"/> E3TimeStamp	0 - Ascending	3 - fdDateTime
<input type="checkbox"/> Field	0 - Ascending	1 - fdInteger

Change field order: Move Up Move Down

OK Cancel

Add Index window

The available options on this window are described on the next table.

Available options for Add Index window

OPTION	DESCRIPTION
Index name	Specifies the index name.
The index fields contain unique data	If enabled, ensures that values specified for this index are unique.
Field name	Shows field's name. Select the ones that must belong to this index.
Order	Shows the selected field's sort order (Ascending or Descending).
Type	Shows table's field type.
Change field order	Changes field's sort order on this table, by moving it up or down on this list.

By clicking **OK**, table indexes are confirmed. To cancel this configuration, click **Cancel**.

16.1.3 Table Settings

After defining all previous options, it is necessary to configure information for a Historic object's table, and then generate this structure on a Database. To do so, right-click a Historic object and select the **Properties** option. Go to the **Historic** tab, according to the next figure.

'Hist1' properties (DB.Hist)

Item | Alarms Area | **Historic** | Links

Database Server:

Table

Type database's table name (use this name later in queries).

Table name:

Interval between records (ms):

Discard

☐ Discard data from the main table

Discard data older than:

Perform discard every:

☐ Move discarded data to the backup table

Discard from backup data older than:

Database structure creation

Click the button to create Historic tables

Historic tab

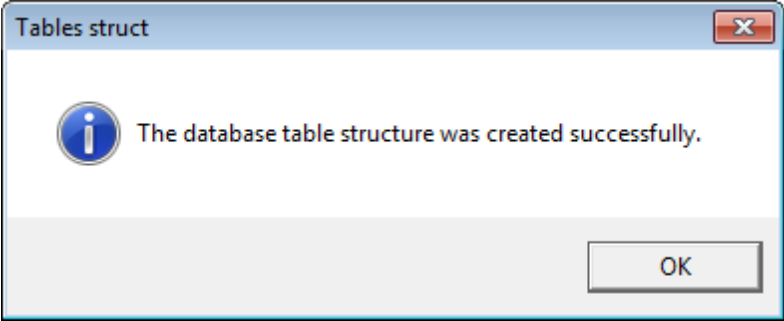
Each field on **Historic** tab has a corresponding property. The available options on this tab are described on the next table.

Available options for Historic tab

OPTION	DESCRIPTION
Database Server	Defines a Database server. This field is equivalent to the DbServer property.

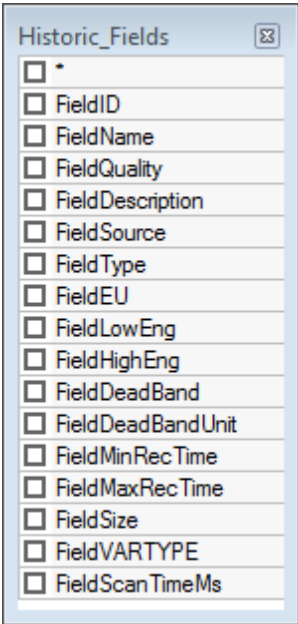
OPTION	DESCRIPTION
Table name	Determines a table name. This field is equivalent to the TableName property.
Interval between records (ms)	Determines a time variation in milliseconds, that is, how often Historic data is stored on a table. This field is equivalent to the ScanTime property.
Discard data from the main table	Enables or disables discarding data from the main table. Data is considered old according to the Discard data older than option. This field is equivalent to the EnableDiscard property.
Discard data older than	Determines a time interval (minutes, hours, days, or months) during which data is kept on the main table. If data is older than the interval on this option, it is discarded. This field is equivalent to the DiscardInterval property and the field to select a time unit for this interval is equivalent to the DiscardTimeUnit property.
Perform discard every	Determines a discard interval (minutes, hours, days, or months) for old data on a table. This field is equivalent to the VerificationUnit property.
Move discarded data to the backup table	Enables or disables storing discarded data on the backup table. This field is equivalent to the EnableBackupTable property.
Discard from backup data older than	Determines a maximum time interval (minutes, hours, days, or months) for data on the backup table until it is discarded, regardless of the time data remains on the main table. For example, to keep data for 24 months on the main table and six more months on the backup table, this option's value must be 30 months. This interval must be longer than the one configured in the Discard data older than option of the main table. This field is equivalent to the BackupDiscardInterval property and the field to select a time unit for this interval is equivalent to the BackupDiscardTimeUnit property.
Create Table	Generates this table structure on the Database. This option is also available by right-clicking a Historic object in Organizer and selecting the Create DB Structure option.

When clicking **Create Table**, Studio displays the dialog box on the next figure.



System message

When the **Create Table** option is used, the table specified on this Historic object is then generated, and also a **_Fields** table. This table contains information about each field stored on a Historic object.




Fields table

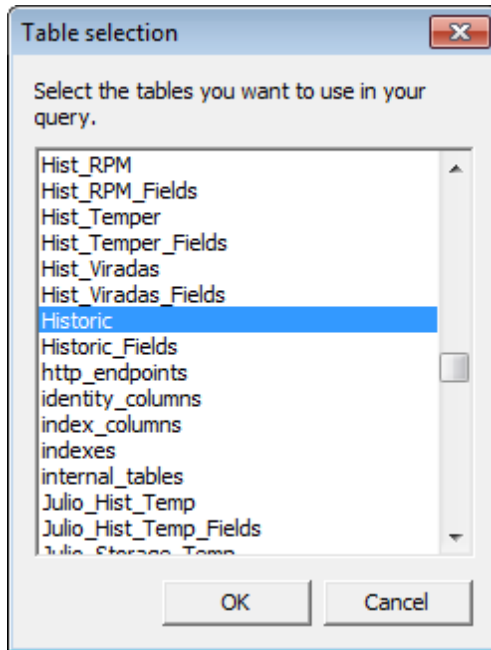
The available fields on the **_Fields** table of a Historic object are described on the next table.

Fields of Historic's **_Fields** table

FIELD	DESCRIPTION
FieldDeadBand	Dead band

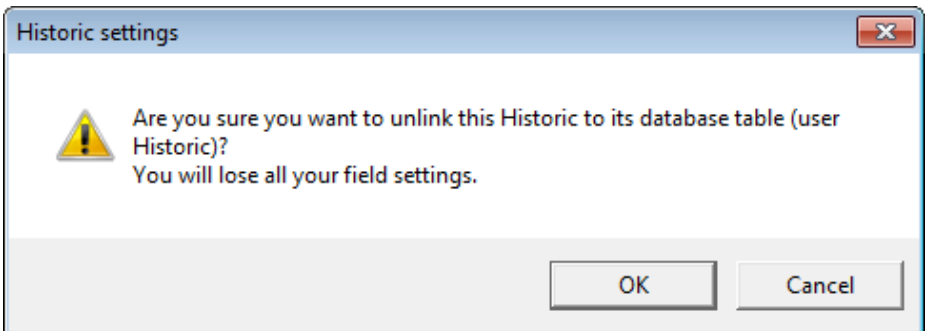
FIELD	DESCRIPTION
FieldDeadBandUnit	Unit used by a dead band (in absolute values or in percentage)
FieldDescription	Field's description
FieldEU	Engineering unit
FieldHighEng	Tag's highest value
FieldID	Index of a field stored on a Historic object
FiledLowEng	Tag's lowest value
FieldMaxRecTime	After this time expires, data must be stored automatically
FieldMinRecTime	Minimum value for a time variation to store data
FieldName	Historic's field name
FieldQuality	Field's quality type. Available options are 0: No quality , 1: Method previous to 1.21 version (where 0: Uncertain quality and 1: Good quality), or 2: Tag's real quality
FieldSize	Field's size
FieldSource	Link used by this field to retrieve its values
FieldType	Field's type

The **Link Historic to existing table**  option links a Historic to an existing table on a Database. When this option is enabled, Studio opens a dialog box to specify which tables are linked to the current Historic object, according to the next figure.





Selecting a table to link to a Historic


After selecting a table and clicking **OK**, Studio displays the message on the next figure.

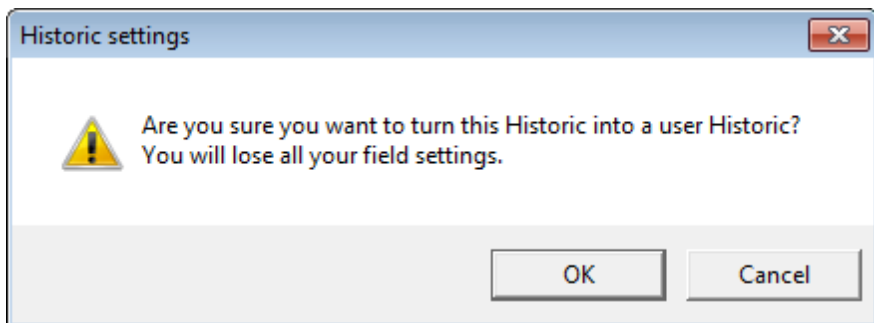


System message

By clicking **Cancel**, fields configured on this table keep their current configuration. However, by clicking **OK**, all fields, indexes, and primary keys defined on a Historic object are replaced by data from the selected table.

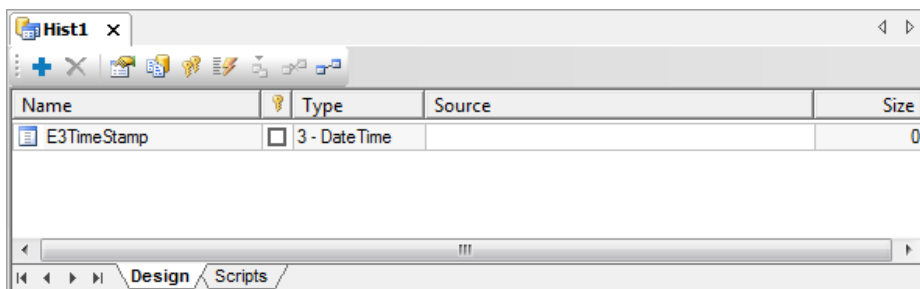
When this item is used, two other options are enabled:  **Keep Historic unlinked to existing table** and  **Get fields from original table**.

When the  **Keep Historic unlinked to existing table** option is enabled, Studio shows the message on the next figure.



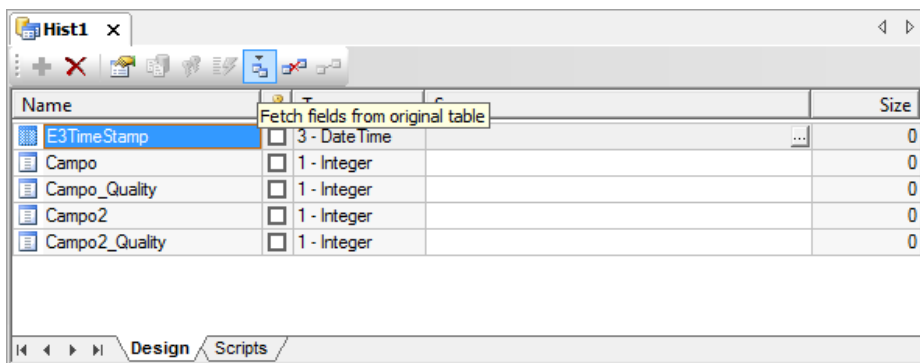
System message regarding Historic setup

By clicking **Cancel**, this table keeps its current configurations. However, by clicking **OK**, this table is restarted with its initial fields, in which there is only a default field enabled (**E3TimeStamp**).



Historic object after enabling the Keep historic unlinked to existing table option

The **Get fields from original table** option, on the other hand, recovers data from a Historic linked to an existing table, which was removed.



Historic object using the Get fields from original table option

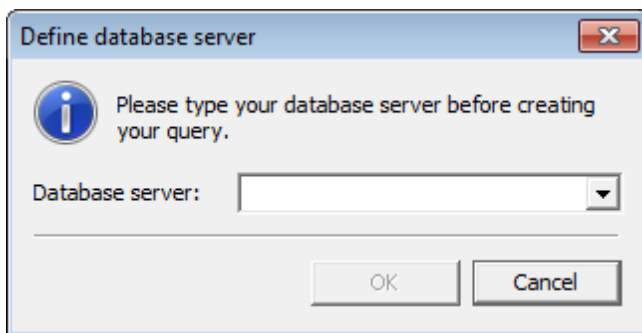
A **Query** object helps in the process of defining Database queries of an application. Every time an E3Browser or a Report object searches for data on a Database, it is necessary to send a command, to know which data is needed for that object. Therefore, every time an application needs to store or retrieve data from a Database, commands are sent in SQL (*Structured Query Language*) format. A Query features a friendly interface that allows building queries in a graphical form, and an immediate preview of the generated SQL code. A Query allows showing data from the last *N* days, hours or months, final and initial date, and queries.

The Query wizard is responsible for creating a text that builds a filter or query, and users have no need to know details such as date, etc. To use this feature, follow these procedures:

1. Right-click a project's Screen and select the **Insert - Standard - Query** option.

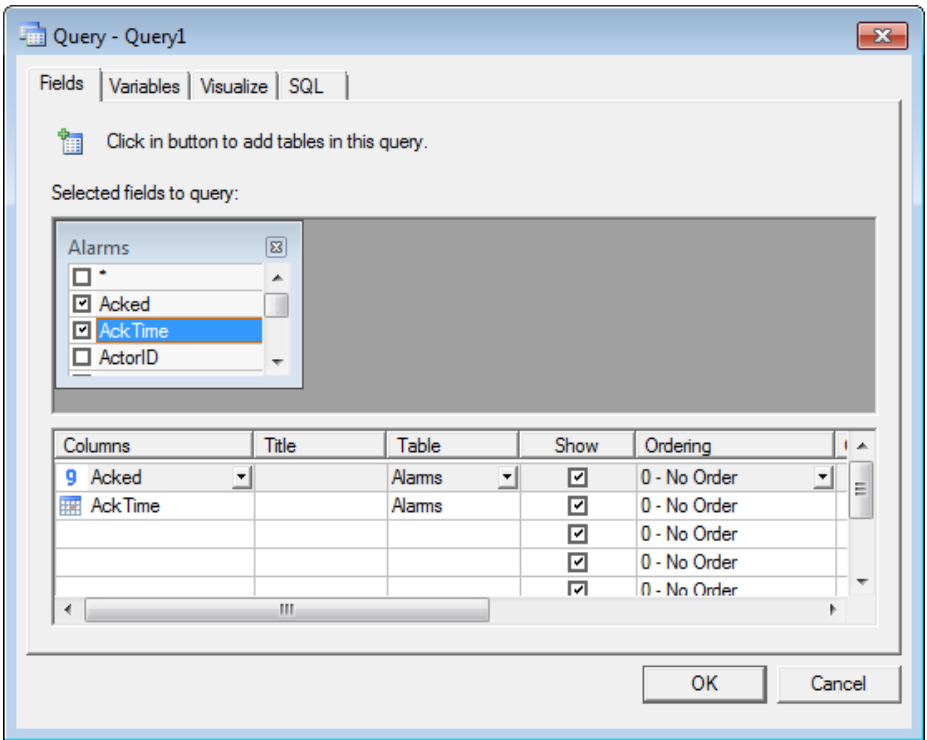
NOTE: When creating a Report or an E3Browser object, a Query object is automatically added to it. However, users can also insert this object on a Data Folder, on a Screen, on a Viewer, or on a Viewer Folder. For more details, please check the corresponding chapters.

Before defining a Query, it is necessary to inform a Database Server that this Query uses to retrieve data. To do so, select a server on the **Database Server** list box:



Defining a Database Server

A Query setup depends on the object to which it is linked.



Query Settings

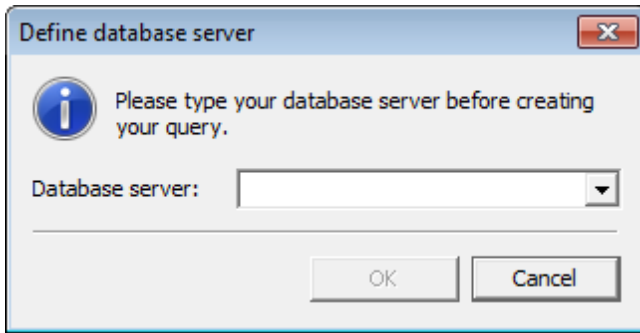
To check which are Query setup requirements, please check the **Report** and **E3Browser** chapters.

Some of this Query properties can be configured using the Properties List, without creating scripts for this. To configure any property, locate it on the Properties List and perform the necessary adjustments. For more information, please check the **Scripts Reference Manual**.

17.1 Creating a Query

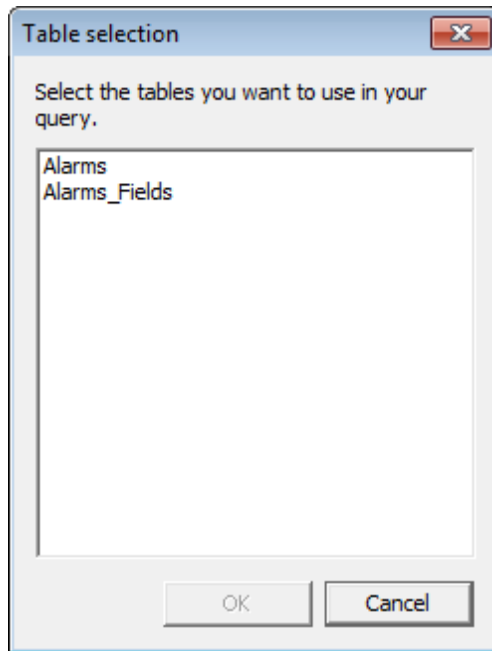
When creating an E3Browser or a Report in a project, a Query is automatically inserted as a child object, named "Query1". To use this feature, follow these procedures:

1. When right-clicking a Query and selecting the **Configure** option, a window is then displayed asking for an application's Database Server.



Definition of a Database Server in a Query

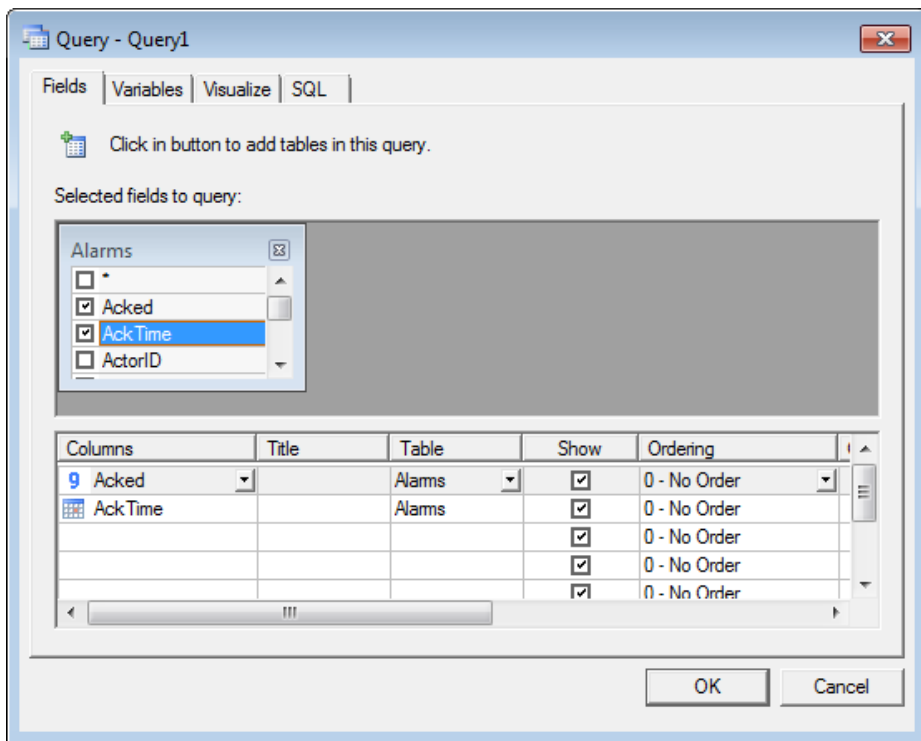
2. After defining a Database server, a new window appears with all tables found on that Database, allowing their selection.



Adding a table

3. Select all tables to use in this query and then click **OK**.
4. After defining all tables, the Query's definition window is displayed with four tabs:
 - **Fields**
 - **Variables**
 - **Visualize**


- SQL

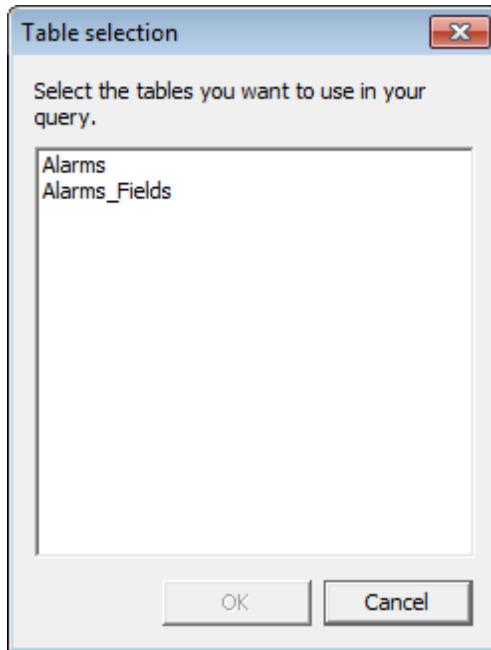


Query setup

These tabs are described on the next topics.

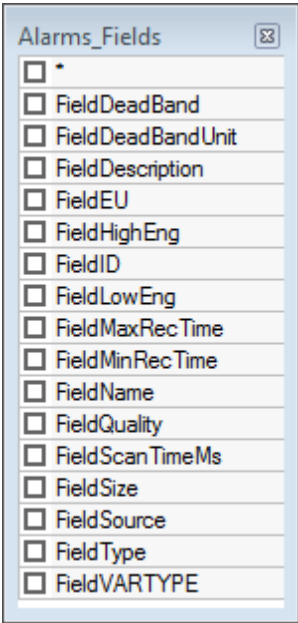
17.1.1 Fields Tab

This tab displays all fields from tables used in a Query. When clicking , it is possible to select other tables for this Query.



Inserting a table

To select all table fields to use in this Query, select the first item on the list box corresponding to an * (asterisk) symbol. To add a specific field, simply select its corresponding check box.



Selecting table fields

Due to performance issues, it is important to add to a Query only fields that are really interesting for analysis.

On the columns' area, the chosen fields are displayed.

Columns	Title	Table	Show	Ordering	Order	Group by	Function	Filter	
<input type="text"/>			<input checked="" type="checkbox"/>	0 - No Or		<input type="checkbox"/>			...
			<input checked="" type="checkbox"/>	0 - No Orde		<input type="checkbox"/>			
			<input checked="" type="checkbox"/>	0 - No Orde		<input type="checkbox"/>			
			<input checked="" type="checkbox"/>	0 - No Orde		<input type="checkbox"/>			
			<input checked="" type="checkbox"/>	0 - No Orde		<input type="checkbox"/>			
			<input checked="" type="checkbox"/>	0 - No Orde		<input type="checkbox"/>			

Columns' area

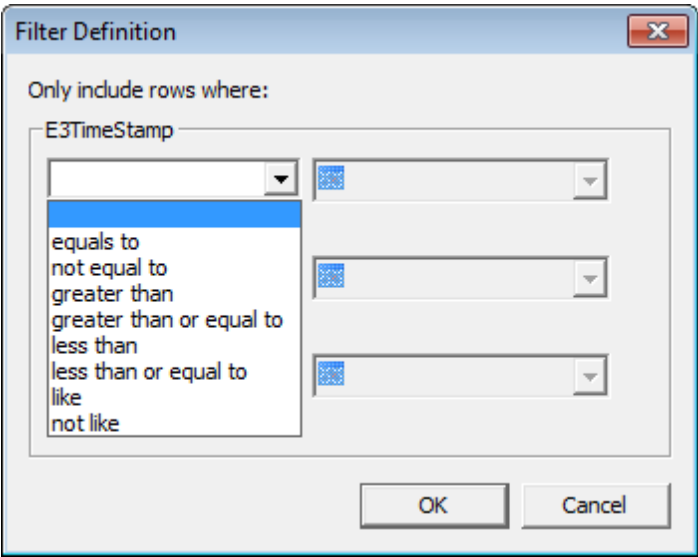
Each column displays the following defined properties for each field of the selected table or tables.

Available options for column setup

OPTION	DESCRIPTION
Columns	Shows the name of selected columns. When clicking the combo box of each row, users can redefine the desired column.
Title	Allows defining a new name for this column (also known as an alias).
Table	Shows the name of a table that this field belongs to.

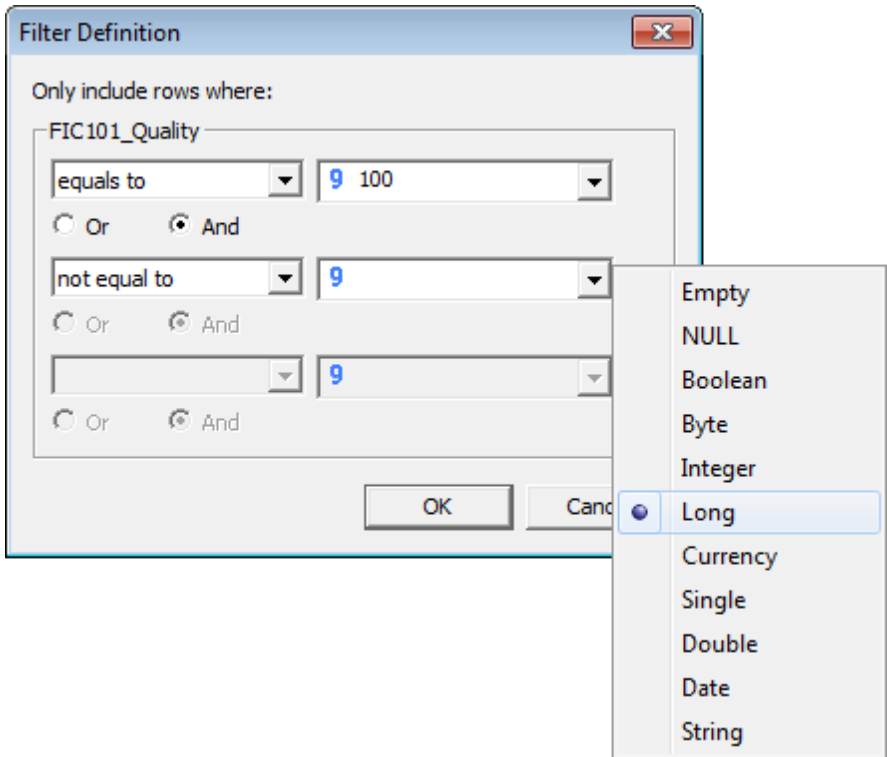
OPTION	DESCRIPTION
Show	Enables or disables this field.
Ordering	Allows sorting values: No sorting , Ascending (lesser values first), and Descending (greater values first).
Order	Defines a priority when more than one field is sorted.
Group by	Allows data to be grouped at each new value of the current field.
Function	Allows defining a function to be executed for this field.
Filter	Defines query's criteria, such as date intervals.

When defining a filter, the window on the next figure appears, allowing to define a comparison type and a value to compare.



Defining a filter

A comparison data type can be defined when clicking the corresponding combo box, and then selecting one of the types on the list box.



Settings to define a filter

Comparison values can be constants (for example, 123, 45, "ABCD", etc.) or user-defined variables. To create a variable, simply type a name between the following symbols:

- <% %> if this value is a number
- '<% %>' if this value is a **String**
- #<% %># if this value is a date

The variable's value can be defined using the **Variables** tab or using the **SetVariableValue** method via Script.

17.1.2 Variables Tab

This tab allows defining default values for user-defined variables. These variables may also have their values changed at run time, by using the **SetVariableValue** method.

Fields
Variables
Visualize
SQL

Configure below variables used in this query:

Name		Value
StartDate		12:00:00 AM
EndDate		12:00:00 AM

Variables tab

The columns of this tab are described on the next table.

Available options for the Variables tab

OPTION	DESCRIPTION
Name	The name of a user-defined variable.
Value	A combo box where value's data type can be defined. These options are Empty , NULL , Boolean , Char , Byte , Integer , Word , Long , Dword , Currency , Single , Double , Date , Decimal , and String .

17.1.3 Visualize Tab

This tab displays a preview of Query results when clicking . Users can also define a maximum number of records to retrieve, to display results faster.

Click in button to run query.

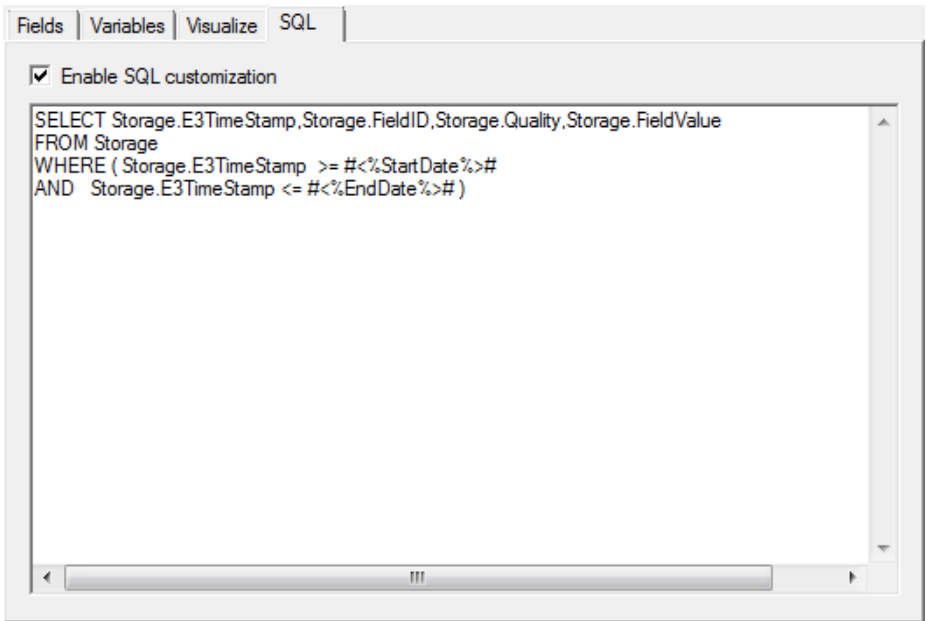
E3TimeStamp	FieldID	Quality	FieldValue	
41330.5309116667	0	192	0	
41330.5309147338	0	0	0	
41330.5309147338	0	192	0.5333	
41330.5309270139	0	192	1.23661861629...	
41330.5309385648	0	192	2.58561733756...	
41330.5309503009	0	192	4.35561889706...	
41330.5309618634	0	192	5.30842632831...	
41330.5309732407	0	192	7.23828384044...	
41330.5309846065	0	192	8.18596416211...	
41330.5309959838	0	192	9.33717242347...	
41330.5310075463	0	192	10.3899584917...	
41330.5310201852	0	192	12.0093817255...	
41330.5310431134	0	192	16.8308265388...	
41330.5310660417	0	192	20.8308265388...	

☐ Return maximum of register(s). Result:

Query preview

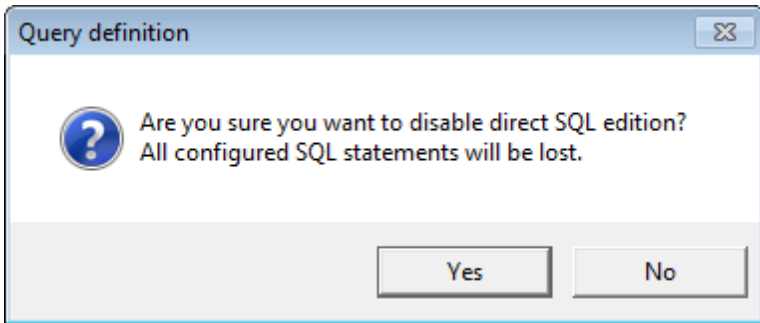
17.1.4 SQL Tab

On this tab, SQL syntax is displayed as a result of all parameters passed. Users can edit a query directly by selecting the **Enable SQL customization** option.



SQL tab

When deselecting the **Enable SQL customization** option, all changes are lost and this Query returns to options selected on the **Fields**, **Variables** and **Visualize** tabs.



Warning when disabling SQL customization

17.2 Using Query Filters via Scripts

To setup and confirm whether a query is correct is only one of the steps when using a Query. Runtime usage and modifications on filter values for a query can be seen in the next script. The **SetVariableValue** method is responsible for defining query parameters, according to values passed via script.

```
Set query = Screen.Item("E3Browser1").Item("Query1")
Query.SetVariableValue "IniDate", _
    Application.GetObject("Data.InternalTag1").Value
Query.SetVariableValue "FinalDate", _
```

```
Application.GetObject("DataFH.InternalTag2").Value  
Screen.Item("E3Browser1").Requery()
```

The **Requery** method allows that new query parameters are really used, as a new query is executed by respecting these new values.

17.3 Using Query Recordsets via Scripts

Another interesting usage of Queries is to work with Recordsets. After executing a Query, it is possible to capture the corresponding Recordset and then work with records row by row, run new queries, etc. In the following command line:

```
RS = IniScreen.E3Browser1.Query1.GetADORecordset()
```

The *RS* variable assumes all features of a Recordset. The advantage of using this feature is that if database properties change, it is not necessary to adjust every script that uses this database.

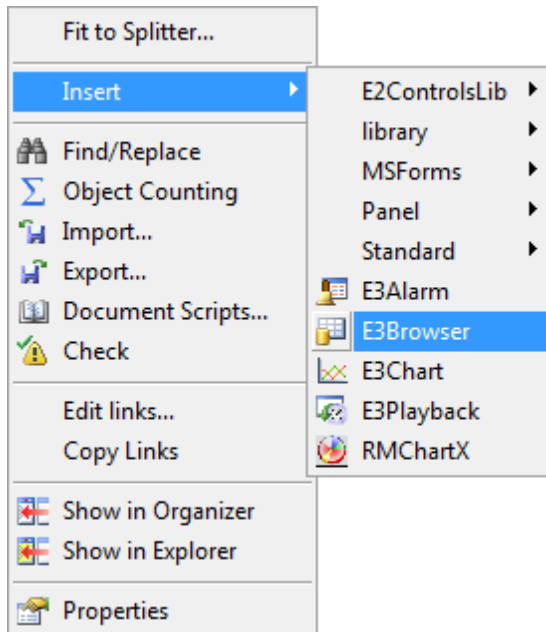
An **E3Browser** is an ActiveX control used for viewing data stored on a Database. Users can configure queries using several data type filters and assign colors for each column, among other settings. This object is used to view historical data, alarms or any existing table on a Database.

	E3TimeSta...	Quality	FieldValue
▶	41330.5309...	192	0
	41330.5309...	0	0
	41330.5309...	192	0.5333
	41330.5309...	192	1.23661861...
	41330.5309...	192	2.58561733...
	41330.5309...	192	4.35561889...
	41330.5309...	192	5.30842632...
	41330.5309...	192	7.23828384...
	41330.5309...	192	8.18596416...
	41330.5309...	192	9.33717242...
	41330.5309...	192	10.333353...
Record: [Previous] [Next] 1 [Previous] [Next] [End] of 18971			

E3Browser

To use this feature, follow these procedures:

1. Insert an E3Browser in the project, by right-clicking the working area and then selecting the **Insert - E3Browser** option.

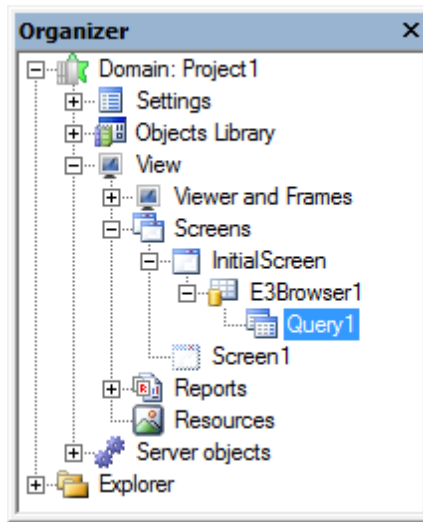


Inserting an E3Browser on a Screen

2. An E3Browser uses a Query object to help users in the process of defining queries on an application Database. For more information, please check the corresponding chapter.
3. If needed, configure E3Browser properties. Some of the properties of this object can be configured using the Properties List, without creating scripts for this. To configure any property, locate it on the Properties List and perform the necessary adjustments. Other information about this object's functionality can be found on the **Scripts Reference Manual**, in its corresponding chapter.

18.1 E3Browser's Query Object

A **Query** is an E3 object that helps users in the process of defining queries on an application Database. Every time an E3Browser retrieves data from a Database, it is necessary to send a command to know which data is needed for that object. Therefore, every time an E3 application needs to store or retrieve data from a Database, these commands are sent in SQL (*Structured Query Language*) format.

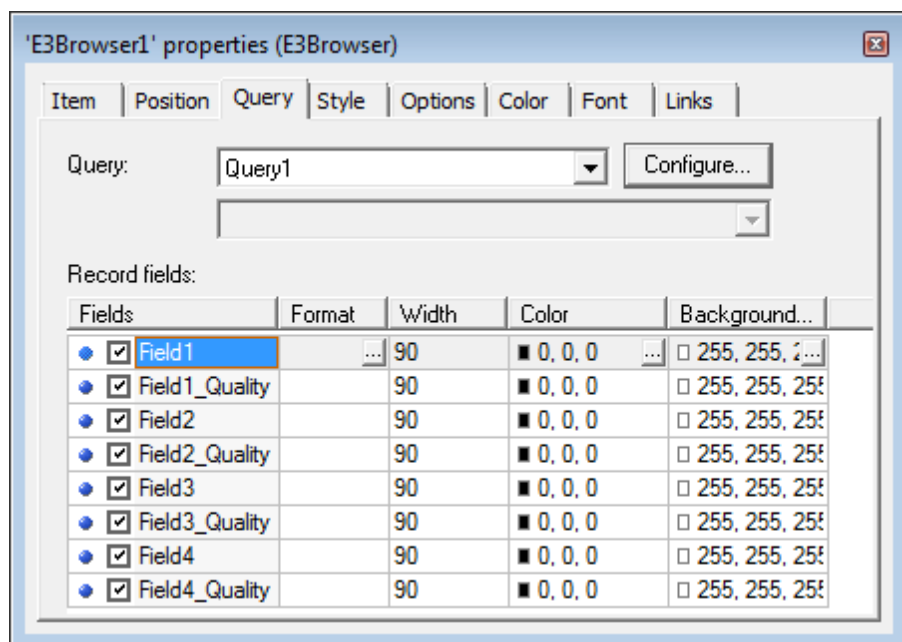


Query in an E3Browser object

A Query presents a friendly interface, allowing users to build queries in a graphical form and an immediate display of the generated SQL code.

NOTE: An E3Browser cannot load Queries located on a server.

The **Query** tab shows all available fields in a Query. Such fields can be accessed by clicking **Configure**, which opens a Query settings wizard.



Query tab

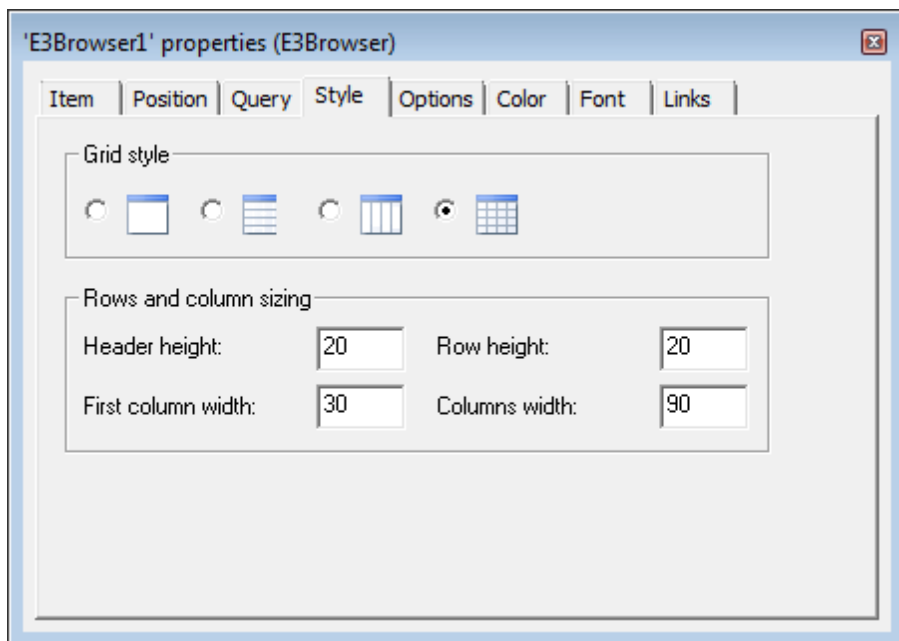
For more information on Queries, please check the **Query** chapter.

18.2 Other Settings

All available settings in an E3Browser are described on the next topics.

18.2.1 Style Tab

By using the **Style** tab, users can define the appearance of cell divisions (grid) and dimensions of rows and columns.



Style tab

Each field on the **Style** tab has a corresponding property. The available properties are described on the next table.

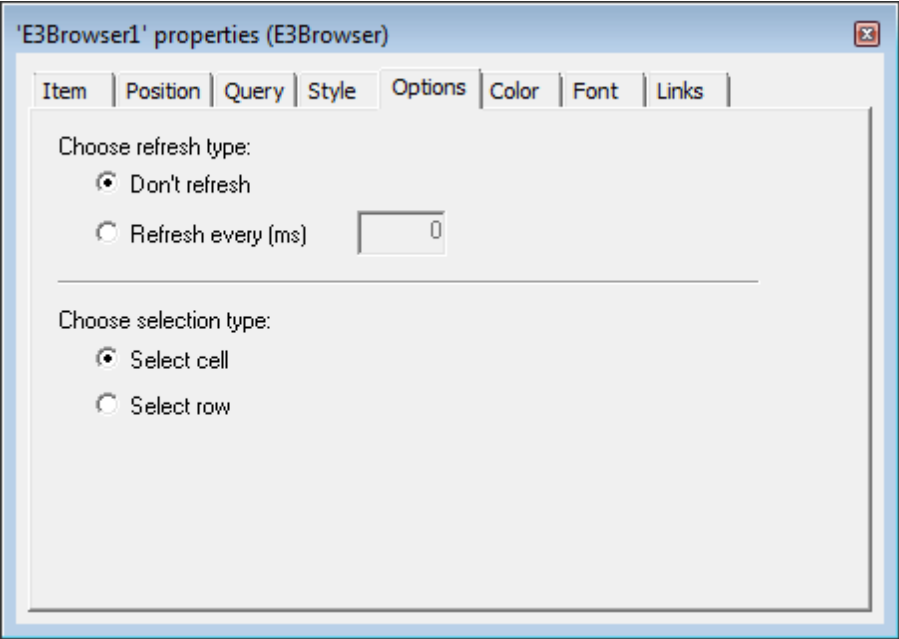
Available options for Style tab

OPTION	DESCRIPTION
Grid style	Specifies E3Browser's grid style. This field is equivalent to the GridLinesType property.
Header height	Specifies E3Browser's header height, in pixels. This field is equivalent to the FixedRowHeight property.
First column width	Specifies the width of the first column on a table. This field is equivalent to the FixedColumnWidth property.
Row height	Specifies the height of the remaining rows on a table. This field is equivalent to the RowHeight property.
Columns width	Specifies the width of table columns. This field is equivalent to the ColumnWidth property.

18.2.2 Options Tab

On the **Options** tab, inform a time interval in which data is stored and updated in an E3Browser. Updates occur in milliseconds (ms). Users can choose to not update

data, causing records to remain unchanged. In the **Choose selection type** option, inform which selection type is performed on a table.



Options tab

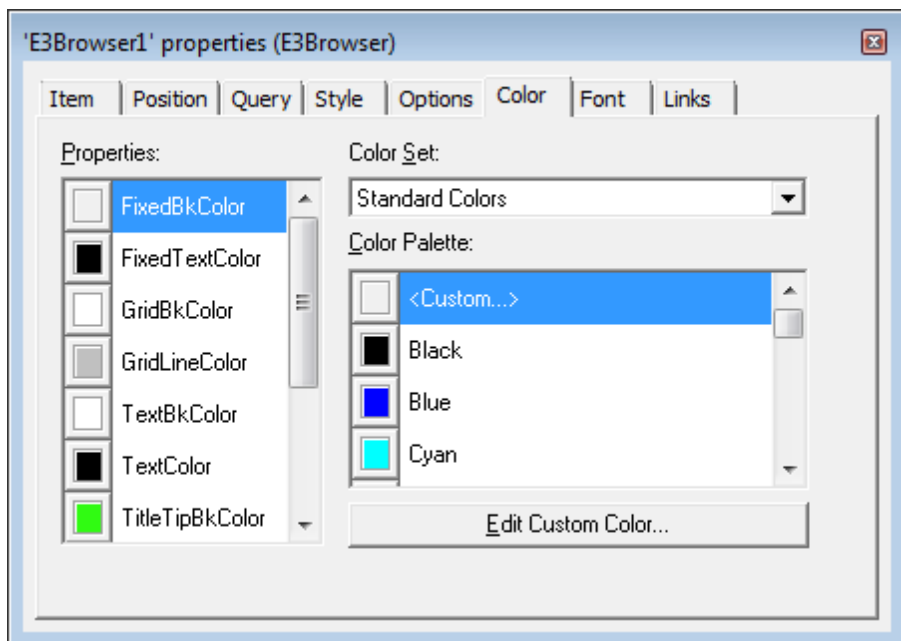
Each field on the **Options** tab has a corresponding property. The available properties are described on the next table.

Available options for Options tab

OPTION	DESCRIPTION
Choose refresh type	Specifies a time interval in which data is updated. This value must be greater than 1000 ms. This field is equivalent to the RefreshTime property.
Choose selection type	Specifies a selection type on E3Browser's table. This field is equivalent to the SelectRow property.

18.2.3 Color Tab

The **Color** tab specifies E3Browser colors referring to its columns and cells. If the desired color is not in the default color palette, it is necessary to set it up by clicking **Edit Custom Color**, which then opens a dialog box to edit a color.



Color tab

The available options on the **Color** tab are described on the next table.

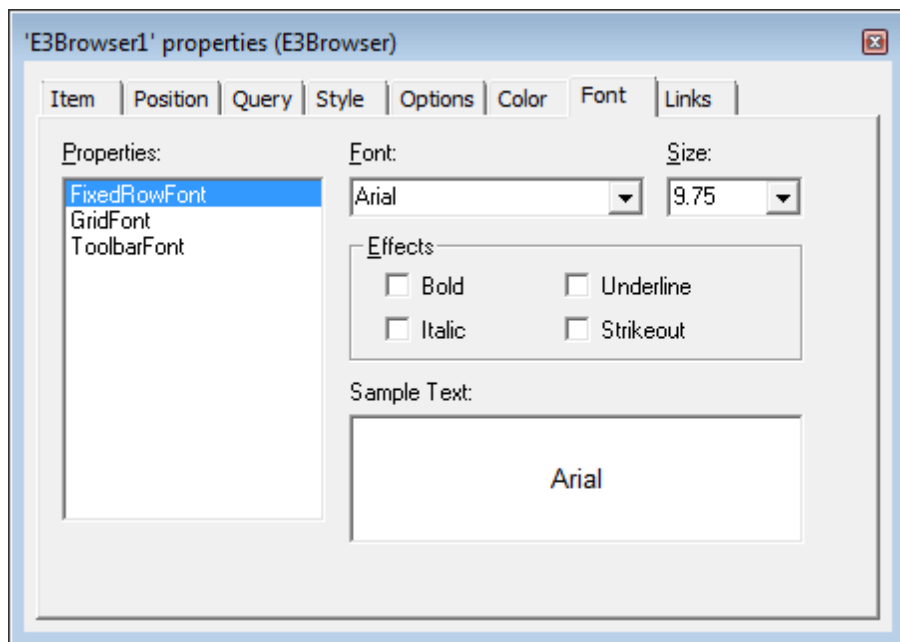
Available options for Color tab

OPTION	DESCRIPTION
Properties	Specifies a color according to the selected property.
Color Set	Specifies a set of colors to use: Standard Colors or Windows System Colors .
Color Palette	Specifies a color for the selected property.
Edit Custom Color	Edits a new custom color, different from default colors.

NOTE: Tab's name appears in the configured Windows language, and not necessarily in E3's current language.

18.2.4 Font Tab

On the **Font** tab, users can define E3Browser's font specifications.



Font tab

The available options are relative to font type, size, and effects.

NOTE: Tab's name appears in the configured Windows language, and not necessarily in E3's current language.

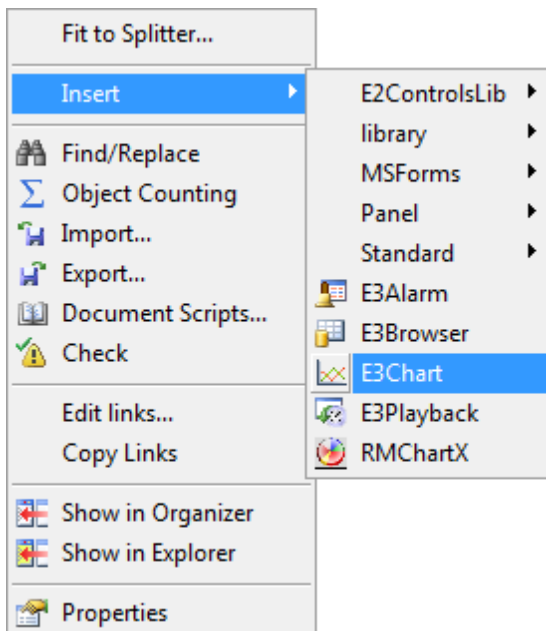
An **E3Chart** is an ActiveX component specially created to work with E3. With this object, users can display charts with Tags varying in real-time, as well as historic data stored on a Database.

An E3Chart is formed by several collections. A collection is a special object that manages a set of similar objects. An E3Chart contains the following collections:

- **Pen Collection:** Manages a set of Pens created to manipulate data sequences represented on an E3Chart
- **Axis Collection:** Manages E3Chart's Axes, where different scales linked to Pens data can be configured
- **Query Collection:** Manages queries containing information about Pens (for example, with charts displaying historic data already stored on a Database)
- **Legend Collection:** Manages E3Chart Legend's columns, where information about Pens is then displayed

To use E3Chart features, follow these procedures:

1. Right-click a Screen and select the **Insert - E3Chart** option.



Inserting an E3Chart on a Screen

2. If necessary, configure E3Chart properties. Some properties of this object can be configured using the Properties List, without creating scripts. To configure any property, locate it on Properties window and perform the necessary adjustments. For more information on E3Chart properties, please check the **Scripts Reference Manual**.

19.1 Settings

To configure an E3Chart, right-click it and select the **Properties** option.

19.1.1 Item, Position, and General Tabs

On **Item** tab, users can view object's name and assign a description to it.

The screenshot shows a dialog box titled "'E3Chart1' properties (E3Chart)". It has several tabs: Item, Position, General, Axis, Pens, Legend, Queries, Font, and Links. The 'Item' tab is selected. Inside the 'Item' tab, there are three main sections: 'Name' with a text field containing 'E3Chart1', 'Documentation' with a large empty text area, and 'Contexts' with a smaller empty text area.

Item tab

Each field on the **Item** tab has a corresponding property. The available options are described on the next table.

Available options for Item tab

OPTION	DESCRIPTION
Name	Determines object's name. This field is equivalent to object's Name property.
Documentation	Free text that enables documenting object's features and functionality by a developer. This field is equivalent to object's DocString property.

The **Position** tab specifies E3Chart's position on a Screen.

The screenshot shows a window titled "'E3Chart1' properties (E3Chart)". It contains a series of tabs: Item, Position, General, Axis, Pens, Legend, Queries, Font, and Links. The 'Position' tab is selected. Inside this tab, there are two main sections. The 'Position' section has two input fields: 'X:' with the value '9445.625' and 'Y:' with the value '2275.4166'. The 'Size' section has two input fields: 'Width:' with the value '10583' and 'Height:' with the value '6615'.

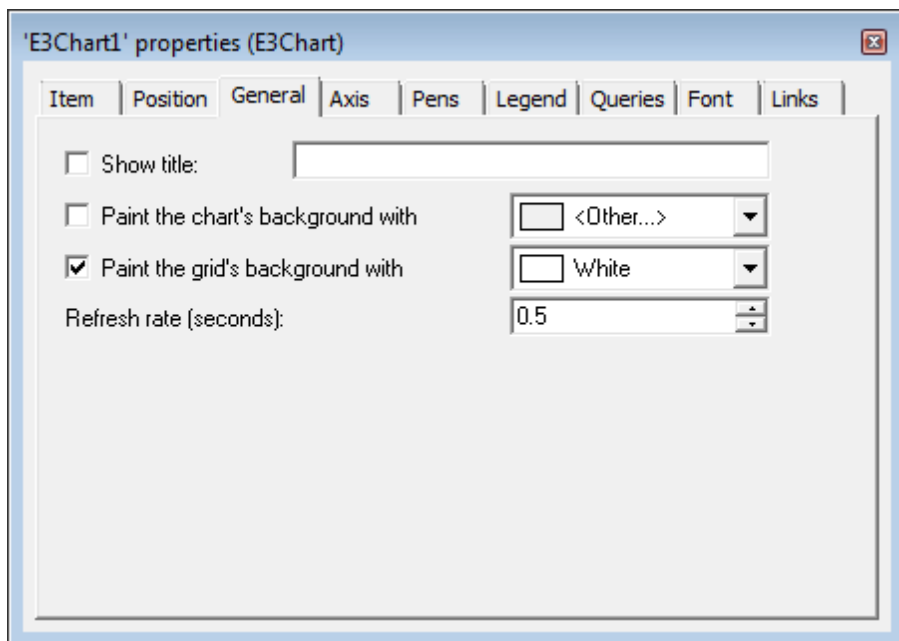
Position tab

Each field on this tab has an equivalent property. The available options are described on the next table.

Available options for Position tab

OPTION	DESCRIPTION
X	Defines object's left horizontal coordinate, in Himetric units. This field is equivalent to object's X property.
Y	Defines object's upper vertical coordinate, in Himetric units. This field is equivalent to object's Y property.
Width	Determines object's width. This field is equivalent to object's Width property.
Height	Determines the object's height. This field is equivalent to object's Height property.

On **General** tab, users can specify chart's style and appearance.



General tab

Each field on the **General** tab has a corresponding property. The available options are described on the next table.

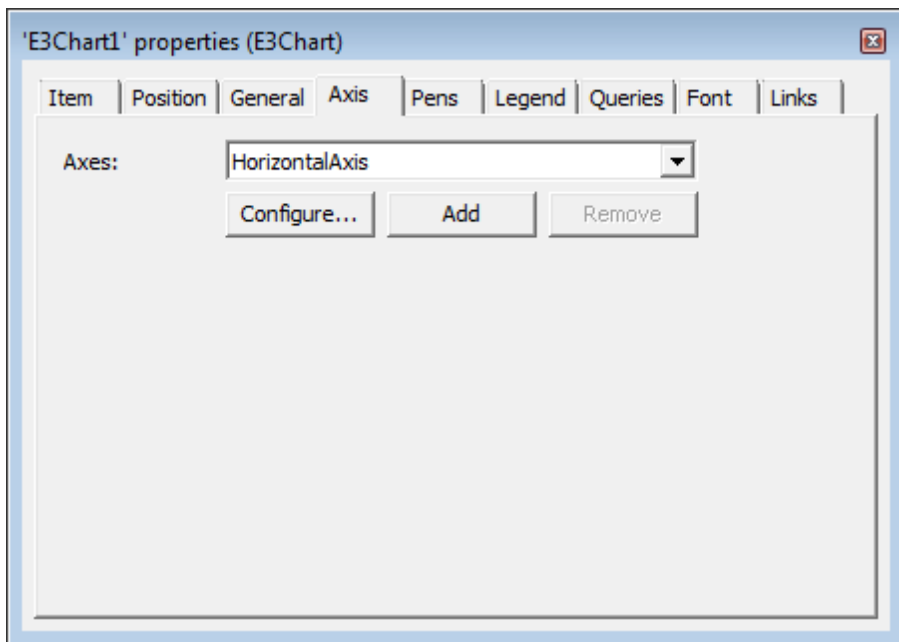
Available options for General tab

OPTION	DESCRIPTION
Show title	Displays chart's title. This field is equivalent to object's Title property.
Paint the chart's background with	Determines chart's background color. This field is equivalent to object's BackColor property.
Paint the grid's background with	Determines grid's background color. This field is equivalent to object's GridBkColor property.
Refresh rate (seconds)	Determines an interval between drawing updates in a chart. This field is equivalent to object's RefreshTime property.

19.1.2 Axis Tab

The **Axis Collection** object represents a set of Axes on an E3Chart. **Axes** are scales outlining an E3Chart grid.

On **Axis** tab, users can add and remove Axes from its Axis Collection, as well as configure their properties individually.



Axis tab

Whenever users create an E3Chart, two main Axes are automatically created, **Horizontal Axis** and **Vertical Axis**. These are default Axes, and they cannot be removed. When clicking **Add**, a new Axis is created on a chart, and a setup window is opened to configure this Axis' properties. This window contains two tabs, **General** and **Scale**, and it can also be opened by clicking **Configure**.

The **General** tab contains information that identifies this Axis in an application.

Axis properties

General | Scale

Properties

Name: HorizontalAxis

Position: at the bottom

Mirror axis: Do not mirror

Axis title:

Axis color: Black

☒ Visible ☐ Display text in axis' color

Grid

Grid line color: Silver

Line style: -----

☒ Show grid lines

Ticks

Tick spacing: 0 second(s)

☒ Automatic

Number of subticks: no subticks

OK Cancel Apply

General tab

Each field on the **General** tab has an equivalent property or method. The available options are described on the next table.

Available options for General tab

OPTION	DESCRIPTION
Name	Determines Axis' name. This field is equivalent to Axis' Name property.

OPTION	DESCRIPTION
Position	Determines Axis' position on a chart: To the left or To the right (vertical Axis) and At the bottom or At the top (horizontal Axis). This field is equivalent to Axis' Position property.
Mirror axis	Shows this Axis on both sides of a chart, creating a mirror effect. This field is equivalent to Axis' Mirror property.
Axis title	Determines Axis' title. This field is equivalent to Axis' Title property.
Axis color	Specifies scale's color. This field is equivalent to Axis' Color property.
Visible	Enables Axis' visibility on a chart. This field is equivalent to Axis' Visible property.
Display text in axis' color	Determines if Axis' text color has the same scale's color. This field is equivalent to Axis' EnableTextColor property.
Grid line color	Determines a grid line color. This field is equivalent to Axis' GridColor property.
Line style	Determines grid line style on a chart. This field is equivalent to Axis' GridStyle property.
Show grid lines	Enables grid lines view. This field is equivalent to Axis' ShowGrid property.
Tick spacing	Determines an interval between scale ticks, if the Automatic option is disabled. If this scale is not numerical, users can select a time unit to which this interval refers. This field is equivalent to Axis' SetTickSpacing method.
Automatic	Automatically selects an interval between scale ticks. This field is equivalent to Axis' SetTickSpacing method, with 0 (zero) as a value for its interval.
Number of subticks	Determines the number of subticks on a scale. This field is equivalent to Axis' MinorTicks property.

Click **Apply** to view changes applied to this window and click **OK** to save them.

The **Scale** tab defines Axis' scale settings.

Axis properties [X]

General **Scale**

Scale type

☐ **Numeric scale**

Maximum:

Minimum:

☒ **Show latest data (Real-time)**

Period:

☐ **Time interval (Historical data)**

from:

to:

☐ **Invert scale**

Formatting

☒ **Automatic**

☐ **Customize**

Type '|' to break line

Scale tab

Each field on this tab has an equivalent method or property. The available options are described on the next table.

Available options for Scale tab

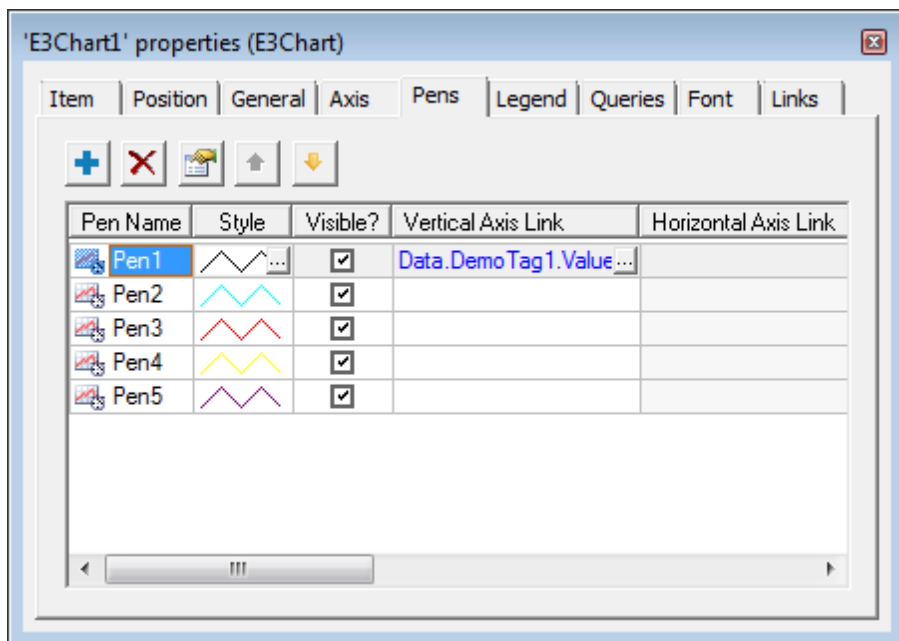
OPTION	DESCRIPTION
Numeric scale	Establishes this Axis as a numerical scale. This field is equivalent to Axis' ScaleType property. Configuration options for numerical scale are: <ul style="list-style-type: none"> • Minimum: Determines the minimum value of a scale. This field is equivalent to Axis' SetMinMax method • Maximum: Determines the maximum value of a scale. This field is equivalent to Axis' SetMinMax method
Show latest data (Real-time)	Shows a time interval to display on this Axis, always relative to the current time. This field is equivalent to Axis' SetRealTimePeriod method.
Time interval (Historical data)	Specifies a fixed time interval. Configuration options are: <ul style="list-style-type: none"> • From: Initial timestamp for this interval • To: Final timestamp for this interval • Select: Select a time interval This field is equivalent to Axis' SetHistoricPeriod method.
Invert scale	Inverts values on the selected scale.
Formatting	Specifies Axis' value format, which can be either automatic or customizable. This field is equivalent to Axis' Format property. For more information about formats, please check topic Value Format .

Click **Apply** to view changes applied to this window and click **OK** to save them.

19.1.3 Pens Tab

The **Pen Collection** object represents a set of Pens on an E3Chart. Each Pen is configured to display real-time or historical data from a Query.






On **Pens** tab, users can add and remove Pens from the Pen Collection, as well as configure their main properties, individually or through Pen's multiple selection.



Pens tab


The available options are described on the next table.

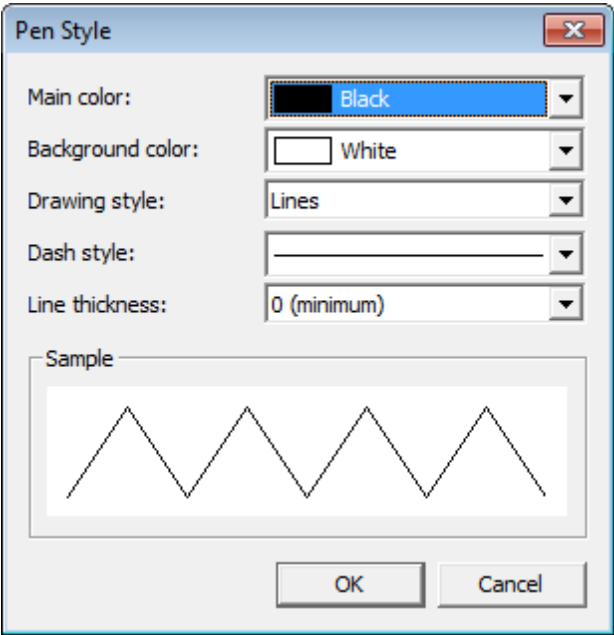
Available options for Pens tab

OPTION	DESCRIPTION
	Adds a Pen. Displays a menu to select the type of Pen to create: Realtime , Historic , or Realtime & Historic .
	Removes the selected Pens.
	Opens the selected Pen's property window (this operation is only allowed if only one Pen is selected).
	Moves the selected Pen one position up (this operation is only allowed if only one Pen is selected).
	Moves the selected Pen one position down (this operation is only allowed if only one Pen is selected).

The list of E3Chart Pens allows copying and pasting Pens on the same E3Chart, as well as among different E3Charts. Right-click a Pen (or the selected Pens, in case of a multiple selection) and select the **Copy** (CTRL + C) option. On the destination E3Chart, open the Properties window and, on **Pens** tab, right-click the list of Pens and select the **Paste** (CTRL + V) option. The **Cut** (CTRL + X) option is also present. If the

destination E3Chart already contains a Pen with the same name of the one currently copied, its name is automatically incremented.

Some Pen properties can be directly configured on the list displayed on **Pens** tab. On **Style** tab, when clicking , the window on the next figure is then displayed.




Pen style

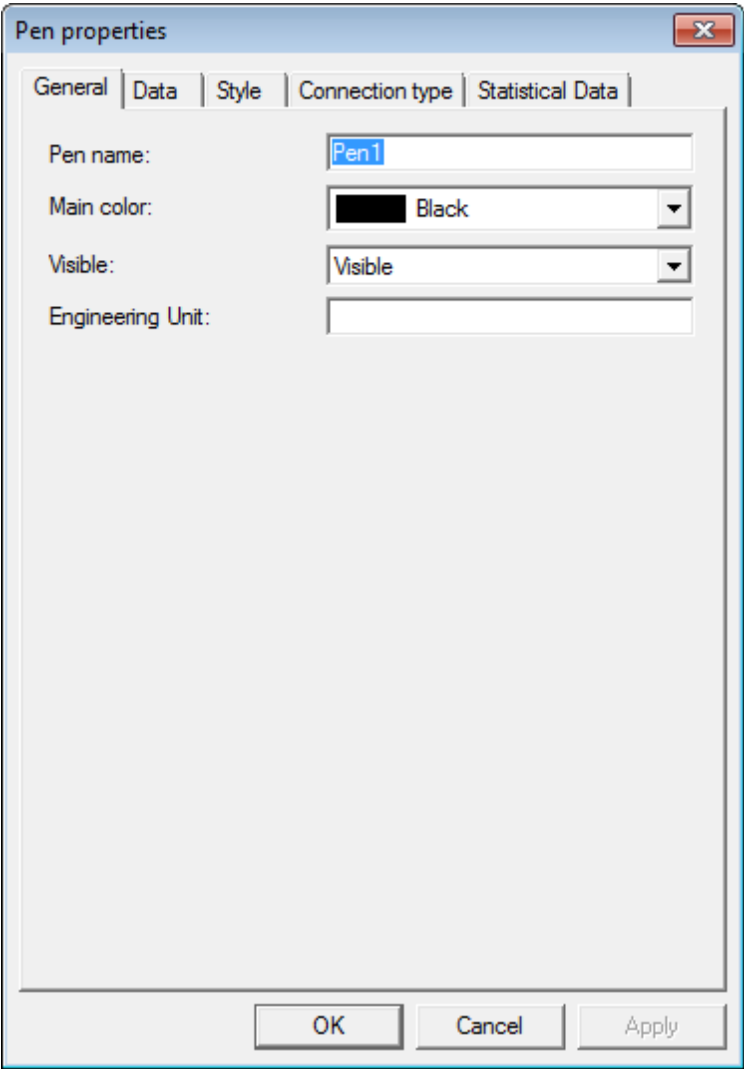
The available options on this window are described on the next table.

Available options for Pen style window

OPTION	DESCRIPTION
Main color	Defines Pen's line color. This is equivalent to Pen's Color property.
Background color	Defines a background color used on an Area -type Pen. This is equivalent to Pen's BkColor property.
Drawing style	Defines Pen's drawing type: Lines , Points , Lines and Points , or Area . This is equivalent to Pen's PenType property.
Dash style	Defines a line type: Solid , Dashed , Dotted , Dash-Dot , Dash-Dot-Dot , or No Line . This is equivalent to Pen's PenStyle property.
Line thickness	Defines a line width. This is equivalent to Pen's Width property.
Sample	Displays an example of how a Pen is drawn on an E3Chart.

When selecting a Pen and clicking , this Pen's property window is displayed. This window contains five tabs: **General**, **Data**, **Style**, **Connection Type**, and **Statistical Data**.

The **General** tab presents information that identifies a Pen in an E3Chart.



The image shows a 'Pen properties' dialog box with five tabs: General, Data, Style, Connection type, and Statistical Data. The 'General' tab is selected. It contains four input fields: 'Pen name' with the value 'Pen1', 'Main color' with a black color swatch and the text 'Black', 'Visible' with a dropdown menu showing 'Visible', and 'Engineering Unit' which is empty. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

General tab

Each field on **General** tab has a corresponding property. The available options are described on the next table.

Available options for General tab

OPTION	DESCRIPTION
Pen name	Indicates Pen's name. This field is equivalent to Pen's Name property.
Main color	Determines Pen's line color. This field is equivalent to Pen's Color property.
Visible	Indicates Pen's visibility status on a chart. This field is equivalent to Pen's Visible property.
Engineering unit	Indicates the engineering unit used by a Pen. This field is equivalent to Pen's EU property.

The **Data** tab contains information depending on Pen's type.

Pen properties

General | **Data** | Style | Connection type | Statistical Data

Pen type: Realtime

Realtime configuration

Vertical axis link: Data.Demo Tag1.Value

Horizontal axis link:

Number of samples kept in memory: 1000

☒ Use TimeStamp

Historical data configuration

Local query:

External query:

Vertical axis field:

Horizontal axis field:

☒ Use automatic query

Assigned axes

Vertical axis: VerticalAxis

Horizontal Axis: HorizontalAxis

OK Cancel Apply

Data tab

Each field on **Data** tab has a corresponding property. The available options are described on the next table.

Available options for Data tab

OPTION	DESCRIPTION
Pen type	Determines Pen's type in use. This field is equivalent to Pen's DataSourceType property.

OPTION	DESCRIPTION
Vertical axis link	Name of a Link used to plot data on a vertical scale. This field is equivalent to Pen's YLink property.
Horizontal axis link	Name of a Link used to plot data on a horizontal scale. This field is equivalent to Pen's XLink property.
Number of samples kept in memory	Specifies the number of samples in real-time Pens. This field is equivalent to Pen's BufferSize property.
Use TimeStamp	Enables or disables a timestamp. A timestamp is a time value that accompanies a Tag value, indicating the moment when this value was changed. This field is equivalent to Pen's UseTimeStamp property. If this field is enabled, the Horizontal Axis Link option remains inactive.
Local query	Determines a Query linked to this E3Chart that is used on Axis data. This field is equivalent to Pen's QueryName property.
External query	Determines an external query, that is, data received from a query outside this E3Chart.
Vertical axis field	Name of a Query field used to plot data on a vertical scale. This field is equivalent to Pen's YField property.
Horizontal axis field	Name of a Query field used to plot data on a horizontal scale. This field is equivalent to Pen's XField property.
Use automatic query	Indicates whether this Pen must use an automatic query. An automatic query is not used if E3Chart uses a user-customized SQL code, if it is using a Storage or if it contains several tables. This field is equivalent to Pen's AutoQuery property.
Vertical axis	Specifies a vertical Axis. This field is equivalent to Pen's ScaleY property.
Horizontal axis	Specifies a horizontal Axis. This field is equivalent to Pen's ScaleX property.

The **Style** tab specifies a Pen's style.

Pen properties

General | Data | **Style** | Connection type | Statistical Data

Pen style

Drawing style: Lines

Dash style:

Line thickness: 0 (minimum)

Background Color: White

Documentation:

Alarms

☐ Enable high alarm: 90

☐ Enable low alarm: 10

Alarm color: Red

Alarm background color: Red

OK Cancel Apply

Style tab

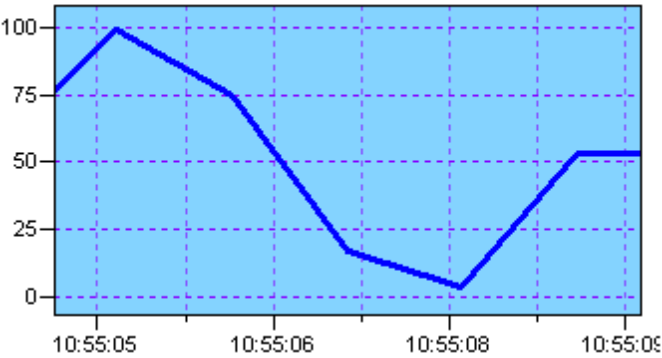
Each field on **Style** tab has a corresponding property. The available options are described on the next table.

Available options for Style tab

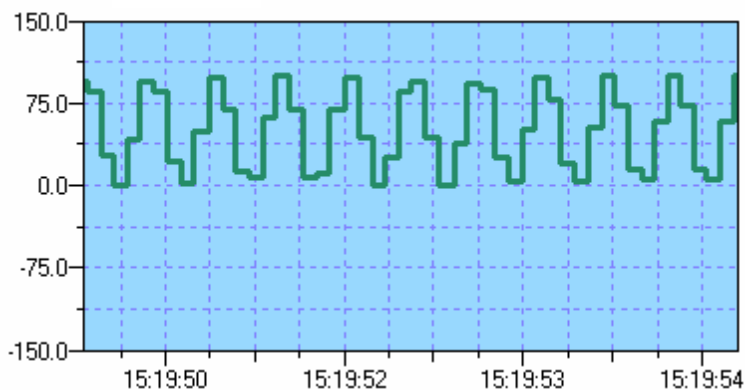
OPTION	DESCRIPTION
Drawing style	Specifies Pen's drawing type. This field is equivalent to Pen's PenType property.
Dash style	Specifies Pen's dash style. This field is equivalent to Pen's PenStyle property.

OPTION	DESCRIPTION
Line thickness	Determines line thickness, in pixels. This field is equivalent to Pen's Width property.
Background color	Specifies line's background color. This field is equivalent to Pen's BkColor property.
Documentation	Specifies a documentation that can be displayed on this Legend. This field is equivalent to Pen's DocString property.
Enable high alarm	Enables a check on a high alarm. This field is equivalent to Pen's EnableHighLimit property. Its text box enables users to establish a limit for this alarm. It is equivalent to Pen's HighLimit property.
Enable low alarm	Enables a check on a low alarm. This field is equivalent to Pen's EnableLowLimit property. Its text box enables users to establish a limit for this alarm. It is equivalent to Pen's LowLimit property.
Alarm color	Pen's color, when in alarm. This field is equivalent to Pen's LimitPenColor property.
Alarm background color	Pen's background color, when in alarm. This field is equivalent to Pen's LimitPenBkColor property.

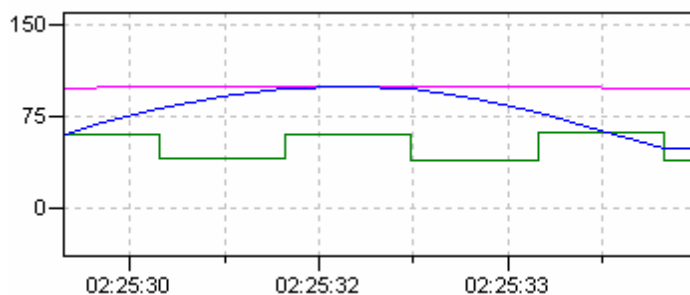
Pen's appearance, according to its configured options, can be viewed on the following figures.



Analog connection mode between points



Digital connection mode between points



The way a Pen is displayed when considering its scan appears in green, and when it is disabled appears in blue and pink

The **Connection Type** tab defines a connection style between historical and real-time parts of a Realtime & Historic Pen.

Pen properties

General | Data | Style | **Connection type** | Statistical Data

Connection type between points

☐ Digital

☒ Analog

Value used for scan (ms):

☒ Show bad quality points

MaxGap Time

Maximum interval to connect historic to real-time data (s):

☐ Highlight line when MaxGap Time is being used

Color of the line with MaxGap Time

Style of the line with MaxGap Time

OK Cancel Apply

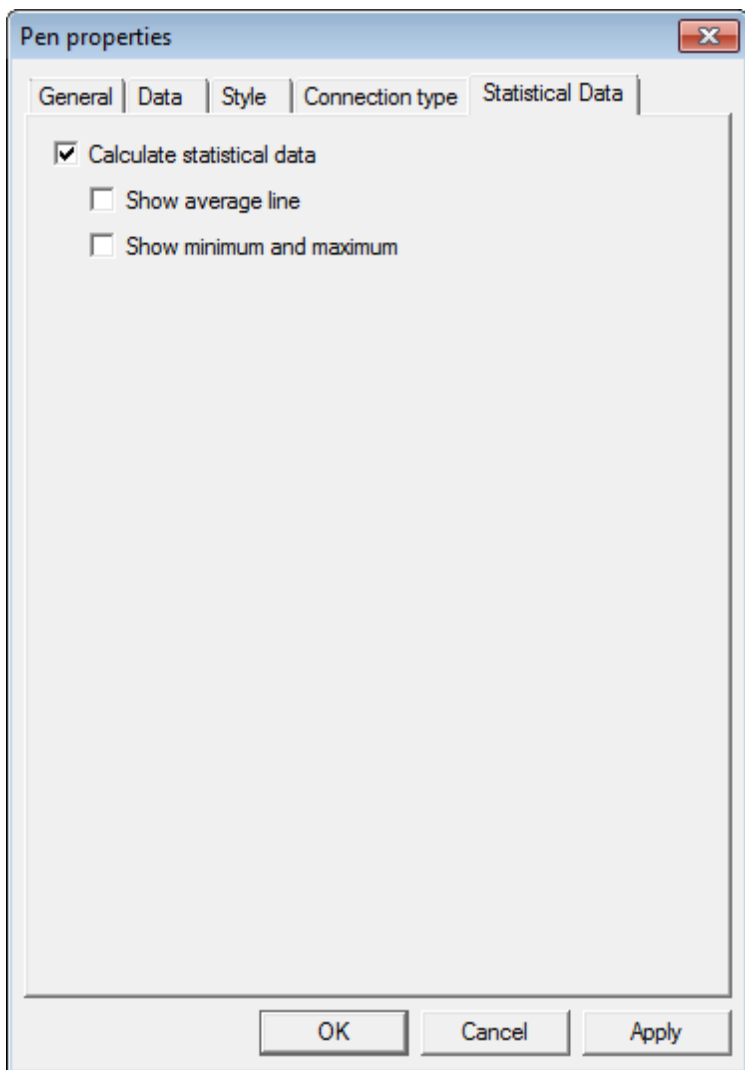
Connection Type tab

The available options on this tab are described on the following table.

Available options for Connection Type tab

OPTION	DESCRIPTION
Connection type between points	Defines the way points between historical and real-time parts are connected. This field is equivalent to Pen's DigitalData property. Available options are Digital , where drawing is always based on horizontal and vertical straight lines only, and Analog , where drawing tries to bind each chart point into a straight line.
Value used for scan (ms)	Defines the expected reading time of a real-time Pen's Tag. If this value is equal to 0 (zero), E3Chart draws only points actually received from a source (Tag). For values different from 0 (zero), E3Chart can create virtual points while not receiving a value from a source and the scan time is exceeded. This field is equivalent to Pen's ScanValue property.
Show bad quality points	Defines whether bad quality points are displayed. This field is equivalent to Pen's ShowBadPoints property.
Maximum interval to connect historic to real-time data (s)	Specifies a limit time to consider for a visual connection between historical and real-time parts of a Realtime & Historic Pen. This field is equivalent to Pen's MaxGapTime property.
Highlight line when MaxGapTime is being used	Highlights a connection line between historical and real-time parts. This field is equivalent to Pen's HighlightMaxGapTime property.
Color of the line with MaxGapTime	Specifies a color for a connection line. This field is equivalent to Pen's MaxGapTimeColor property.
Style of the line with MaxGapTime	Specifies a style for a connection line. This field is equivalent to Pen's MaxGapTimeStyle property.

The **Statistical Data** tab enables statistical data calculations.



Statistical Data tab

Each field on **Statistical Data** tab has a corresponding property. The available options are displayed on the next table.

Available options for Statistical Data tab

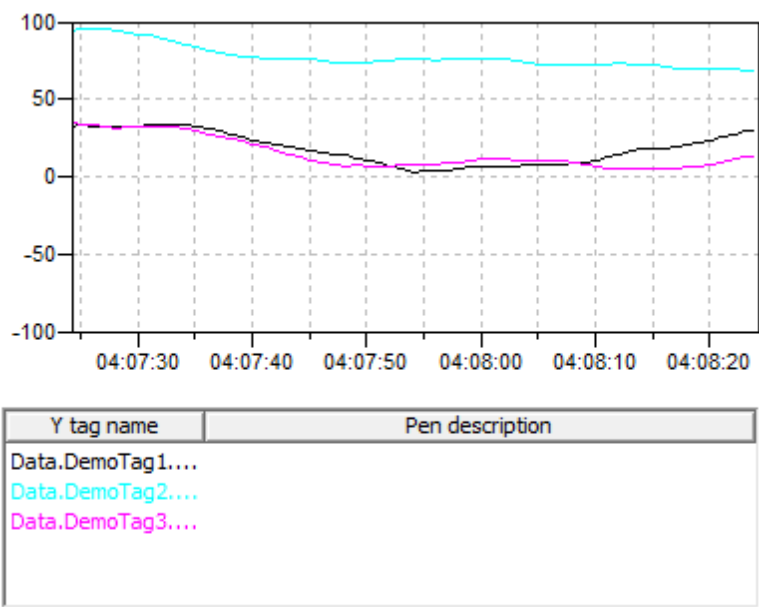
OPTION	DESCRIPTION
Calculate statistical data	Enables statistical data calculation.
Show average line	Displays an average line for statistical data. Please check the NOTE further on this topic.

OPTION	DESCRIPTION
Show minimum and maximum	Displays minimum and maximum values for statistical data.

NOTE: The average calculated by the **Show average line** option is not a simple harmonic mean, but a weighted harmonic mean relative to the time interval of statistical data.

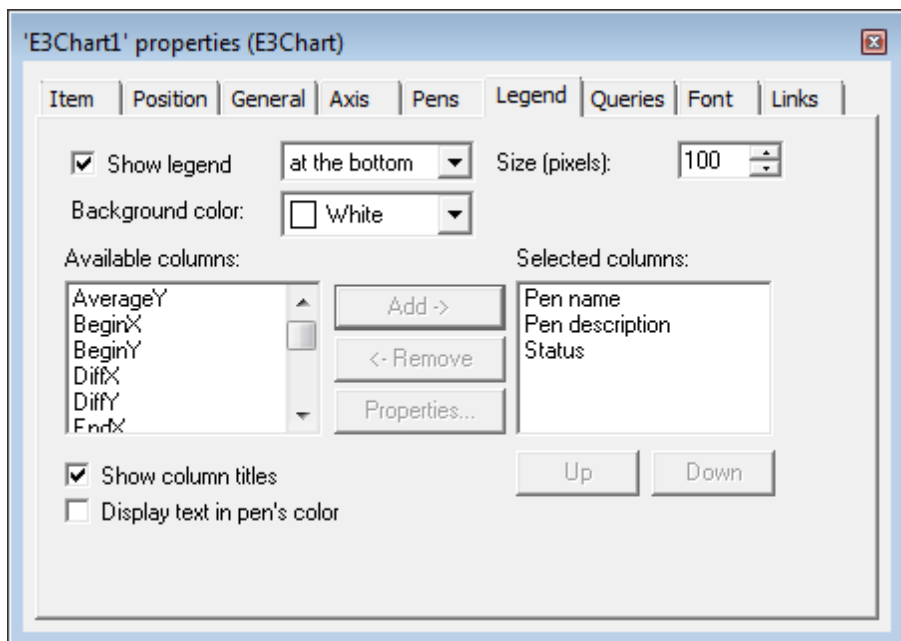
19.1.4 Legend Tab

A **Legend** is used to show visible Pens on a chart, as well as information about them, such as color, Pen's name, status, etc.



A Legend object at run time

On **Legend** tab, users can configure information referring to a Legend object and its columns.



Properties of a Legend object

Some fields on this tab have a corresponding property or method. The available options are described on the next table.

Available options for Legend tab

OPTION	DESCRIPTION
Show Legend	Enables viewing a Legend. The list box near this option defines a Legend's position. This field is equivalent to Legend's Visible property, and the list box for Legend's position is equivalent to Legend's LegendPos property.
Size	Determines a Legend's size, in pixels. Depending on its position, it can be its width or height. The other dimension then follows E3Chart. This field is equivalent to Legend's Size property.
Background color	Determines a Legend's background color. This field is equivalent to Legend's BackColor property.
Available columns	Lists all columns available for visualization on a Legend.
Selected columns	Shows the selected columns for a Legend.
Add	Adds a column to a Legend. This option is equivalent to Legend's InsertColumn method.

OPTION	DESCRIPTION
Properties	Opens a dialog box to configure properties of Legend's column fields.
Remove	Removes the selected column from a Legend. This option is equivalent to Legend's RemoveColumn method.
Up and Down	Changes the position of a Legend's column. These options are equivalent to Legend's ChangeColumnPos method.
Show column titles	Enables a header on a Legend. This field is equivalent to Legend's ShowHeader property.
Display text in pen's color	Determines if Legend's text color is the same as Pen's color. This field is equivalent to Legend's EnableTextColor property.

Fields on the **Available columns** list are described on the next table.

Available options for column identification

¹ This value can be used directly on Legend's **InsertColumn (Col parameter)**, **Item**, and **RemoveColumn** methods

OPTION	VALUE ¹	NAME	DESCRIPTION
AverageY	10	AverageY	Shows Pen's average value in this interval.
BeginX	13	XBegin	Shows cursor's initial position.
BeginY	17	YBegin	Shows an interpolated point where initial cursor meets a Pen.
DiffX	15	DiffX	Shows the difference between initial and final cursors.
DiffY	16	DiffY	Shows the difference between initial and final interpolated points on the Y Axis.
EndX	14	XEnd	Shows cursor's final position.
EndY	18	YEnd	Shows the interpolated point where final cursor meets a Pen.

OPTION	VALUE ¹	NAME	DESCRIPTION
MaximumY	12	MaxY	Shows Pen's maximum value in this interval.
MinimumY	11	MinY	Shows Pen's minimum value in this interval.
Pen color	6	Color	Shows Pen's color.
Pen description	5	Description	Shows the text in Pen's DocString property.
Pen name	0	Name	Shows Pen's name.
Status	7	Status	Shows current Pen status.
Unit	19	EU	Shows Pen's engineering unit.
X tag name	1	TagX	Shows Tag's name associated to an X Axis.
X tag value	3	TagXValue	Shows search value on X Axis.
XScale	8	ScaleX	Shows X Axis' name associated to a Pen.
Y tag name	2	TagY	Shows Tag's name associated to an Y Axis.
Y tag value	4	TagYValue	Shows search value on Y Axis.
YScale	9	ScaleY	Shows Y Axis' name associated to a Pen.

When clicking **Properties**, a dialog box is shown to configure a Legend Column object.

Description column properties window

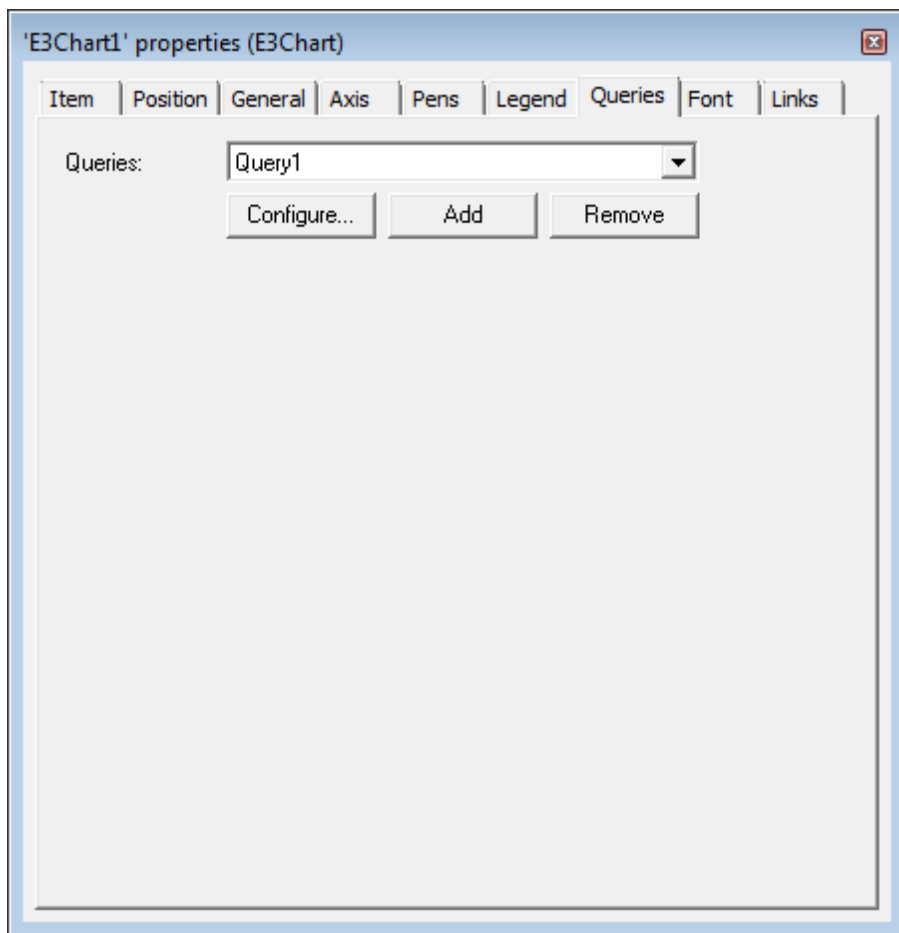
Each field on this dialog box has a corresponding property. The available options are described on the next table.

Available options for Description column properties window

OPTION	DESCRIPTION
Initial width	Defines column's initial width, in pixels. This field is equivalent to Legend Column's Width property.
Column title	Determines column's title. This field is equivalent to Legend Column's Caption property.
Text alignment	Determines Legend column's text alignment. This field is equivalent to Legend Column's TextAlign property.
Format	Specifies a format for the selected column. This field is equivalent to Legend Column's Format property.

19.1.5 Queries Tab

Queries are used to display Historic values on an E3Chart. On **Queries** tab, users can add or remove Queries, as well as configure them.



Queries tab

The available options are described on the next table.

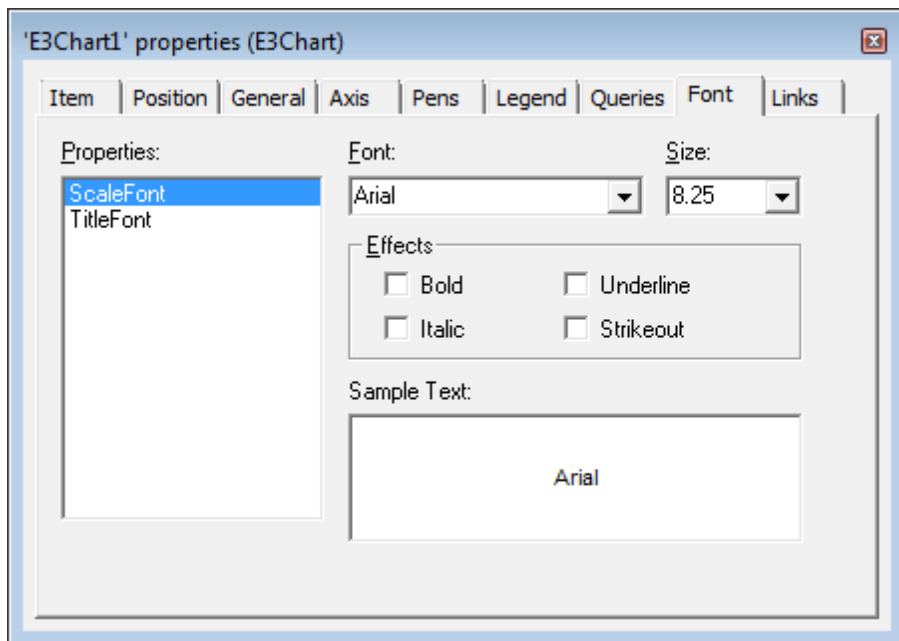
Available options for Queries tab

OPTION	DESCRIPTION
Queries	Shows the selected Query for edition.
Configure	Configures the selected Query.
Add	Adds a new Query. For more information on Queries, please check the Queries chapter.
Remove	Removes the selected Query.

NOTE: When clicking **Add** or **Configure**, a dialog box is opened to specify a Database Server that stores this Query. Procedures to define a Query can be found on **Queries** chapter.

19.1.6 Font Tab

On **Font** tab, users can configure E3Chart's header and row fonts.



Font tab

The available options are relative to font type, size, and effects.

NOTE: This tab's name always appears in the configured Windows language, and not necessarily in E3's current language.

19.2 Usage Examples

The next topics show some examples on how to use an E3Chart.

19.2.1 Enabling and Disabling Pens

The following example shows how to enable or disable Pen's data connection on an E3Chart. To do so, follow these procedures:

1. Create an E3Chart on a Screen.
2. Go to E3Chart's properties and select **Pens** tab. Create a new Real Time Pen, and then link it to a Demo Tag on E3Chart's vertical Axis.
3. Create two Command Buttons on this Screen. On the first one, write "Disable Pen" in its **Caption** property.

4. Open this Button's properties and select **Scripts** tab. On Command Button's **Click** event, write the following script:

```
Sub CommandButton1_Click()  
    Set Pen1= Screen.Item("E3Chart1").Pens.Item("Pen1")  
    Pen1.Disconnect()  
End Sub
```

5. On the second Command Button, write "Enable Pen" in its **Caption** property.
6. Open this Button's properties and select **Scripts** tab. On Command Button's **Click** event, write the following script:

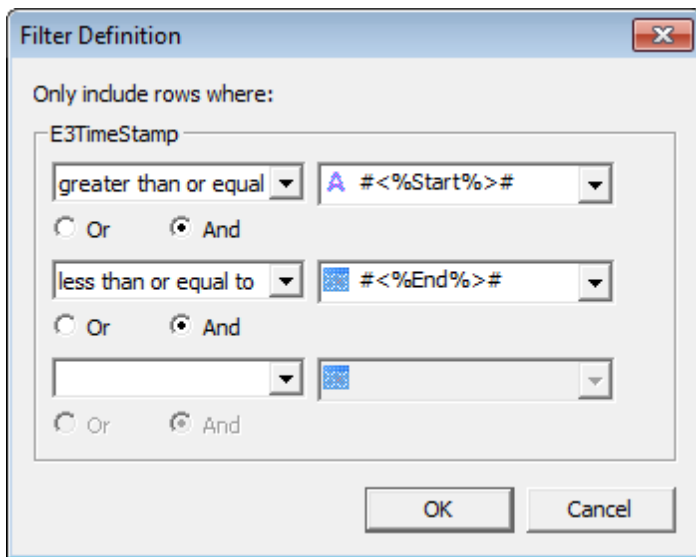
```
Sub CommandButton2_Click()  
    Set Pen1= Screen.Item("E3Chart1").Pens.Item("Pen1")  
    Pen1.Connect()  
End Sub
```

7. Run this project and check its results.

19.2.2 Updating Historic E3Chart with Data from the Last Hour

The following example shows how to update an E3Chart with historical data from the last hour. For this example, it is necessary to have a Query to a previously created Database table.

1. Create an E3Chart on a Screen.
2. Go to E3Chart's properties, select **Axis** tab, and then click horizontal Axis' **Configure** option. Select **Scale** tab and then select the **Time Interval (Historic Data)** option.
3. Go to **Queries** tab and then click **Add**. The application opens a dialog box to indicate the name of a Database server where Query's table is going to be stored.
4. Select a Database server on this dialog box and then click **OK**. The application then opens a Query configuration window.
5. On the historical table, select the **E3TimeStamp** field, as well as some other data field to display on this chart.
6. In the **E3TimeStamp** field, create a filter according to the following specifications:



Filter for the E3TimeStamp field

7. After creating a filter based on the previous specifications, click **OK**.
8. Create a new Pen. Go to this Pen's properties and, on **Data** tab, **Pen Type** item, select the **Historic** option, and then indicate the configured Query field.
9. Indicate a table field in the **Vertical Axis Field** item. In the **Horizontal Axis Field** item, indicate the **E3TimeStamp** field. Click **OK**.
10. Create a new Command Button on this Screen and, in its **Caption** property, write "Update Historical E3Chart".
11. Go to this Button's scripts and, on its **Click** event, write the following code:

```
Sub CommandButton3_Click()
    Set Chart = Screen.Item("E3Chart1")
    Query.SetVariableValue "Start", now - 1 / 24
    Query.SetVariableValue "End", now
    Chart.HorScaleBegin = now - 1 / 24
    Chart.HorScaleEnd = now
    Chart.Queries.UpdateData()
End Sub
```

12. Run this project and check its results.

19.2.3 Enabling or Disabling Pen Visualization

The following example shows how to enable or disable Pen's visualization on an E3chart. To do so, follow these procedures:

1. Create an E3Chart on a Screen.

2. Go to E3Chart's properties and select **Pens** tab. Create a new Real Time Pen and link it to a Demo Tag, on its horizontal Axis.
3. Create two Command Buttons on this Screen. On the first one, write "Disable Pen Visualization" in its **Caption** property.
4. Go to this Button's properties and select **Scripts** tab. On Command Button's **Click** event, write the following code:

```
Sub CommandButton1_Click()  
    Set Pen1= Screen.Item("E3Chart1").Pens.Item("Pen1")  
    Pen1.Visible = False  
End Sub
```

5. For the second Command Button, change its **Caption** property to "Enable Pen Visualization".
6. Go to this Button's properties and select **Scripts** tab. On Command Button's **Click** event, write the following code:

```
Sub CommandButton2_Click()  
    Set Pen1 = Screen.Item("E3Chart1").Pens.Item("Pen1")  
    Pen1.Visible = True  
End Sub
```

7. Run this project and check its results.

19.2.4 Creating a Pen via Scripts

The following example shows how to create a Pen via script. To do so, follow these procedures:

1. Create an E3Chart on a Screen.
2. Create a Command Button on this Screen. For its **Caption** property, write "Create Pen".
3. Go to this Command Button's properties and select **Scripts** tab. Type the following script on its **Click** event:

```
Sub Text1_Click()  
    Set E3Chart1 = Screen.Item("E3Chart1")  
    MsgBox "Click OK to create the Pen"  
    Set Pen = E3Chart1.Pens.AddPen("Pen1")  
    Pen.DataSourceType = 0 ' realtime  
    Pen.VerDataSource = "Data.DemoTag1"  
    Pen.UseTimeStamp = true ' At x uses timestamp  
    Pen.Color = RGB(255, 0, 0)  
    Pen.DocString = "test"  
    MsgBox "Click OK to connect"  
    Pen.Connect() ' Starts getting data  
    MsgBox "Click OK to frame"  
    E3Chart1.FitPen(0)
```

```
MsgBox "Click OK to disconnect"  
Pen.Disconnect() ' Stops receiving data  
MsgBox "Click OK to remove Pen"  
E3Chart1.Pens.Remove(Pen.Name)  
End Sub
```

4. Run this project and check its results.

19.3 Specific Runtime Behavior

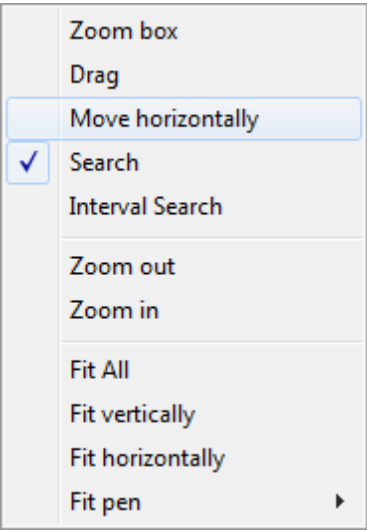
An E3Chart has a series of features only available at run time. They are described on the next topics.

19.3.1 Mouse Pointer Options

When clicking a chart's legend, users can resize its columns. To do so, select a column and drag it.

19.3.2 Contextual Menu Options

When right-clicking an E3Chart, a contextual menu is then displayed.



E3Chart's contextual menu options at run time

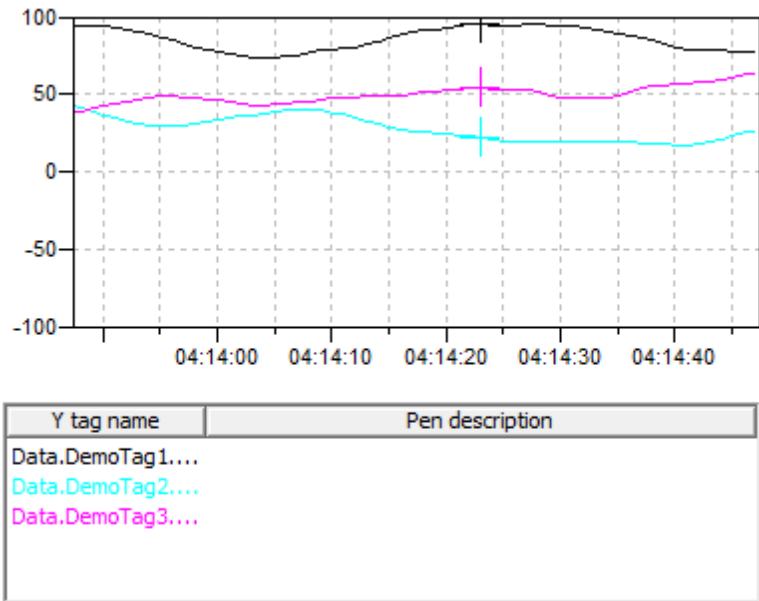
The available options are described on the next table.

Available options for E3Chart's contextual menu at run time

OPTION	DESCRIPTION
Zoom box	Sets mouse in Zoom mode by selected area. This option is available in XY numerical scale and fixed scale charts.
Drag	Sets mouse in Drag mode.
Move horizontally	Sets mouse in Horizontal Drag mode only.
Search	Sets mouse in Value Search mode in Pen's data.
Interval Search	Enables Interval Search mode.
Zoom Out	Decreases zoom for the whole Axis.
Zoom In	Increases zoom for the whole Axis.
Fit all	Fits the selected Pen on both Axes.
Fit vertically	Fits the selected Pen on vertical Axis only.
Fit horizontally	Fits the selected Pen on horizontal Axis only.
Fit Pen	Fits the selected Pen or all existing Pens.

19.3.3 Search Option

This option allows searching Pen's point values. These values are displayed on a legend, using **XTagValue** and **YTagValue** columns.

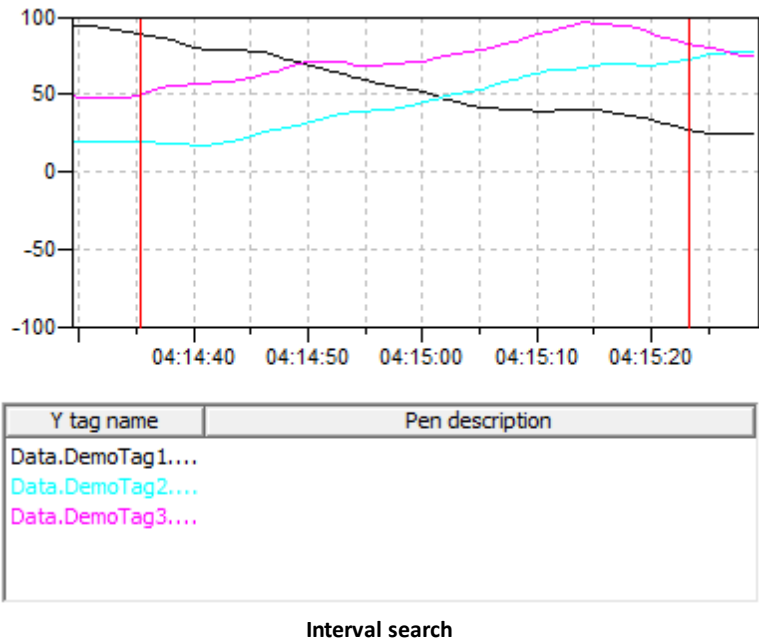


Search is displayed in TagXValue and TagYValue fields

NOTE: For more information on **XTagValue** and **YTagValue** columns, please check topic **Legend Tab**.

19.3.4 Interval Search Option

When this mode is on, two cursors are displayed to define statistical calculation interval. Cursor values are displayed on **BeginX**, **BeginY**, **EndX**, and **EndY** columns. To change a cursor position, left-click it and then drag it to the desired position.



19.3.5 Legend Status Column

The **Legend Status** column displays the current status of every Pen. The content of that message is formed by an error information, if available, and information about the current status of a Pen, such as the number of points. The next two tables show all possible error and information messages for Realtime and Historic Pens. If a Pen is both Realtime and Historic, then the final message is a combination of Realtime and Historical parts. In case there are error messages, the column's row is displayed in red while that error persists.

Status messages for the real time part

MESSAGE	MEANING
Error: Real time data disconnected (YLink = 'Tag Name') (XLink = 'Tag Name')	There is no connection from Pen's real time part. Check Tag names in Pen's YLink and XLink properties.

MESSAGE	MEANING
Info: Real time <i>n</i> pts	Displays the total amount of points on the real time part.

Status messages for the historical part

MESSAGE	MEANING
Info: <i>Query Name</i> waiting	Waiting for query initialization. This means that some query's change or update request has been detected.
Info: <i>Query Name</i> initializing	This query is starting. At this time there is a validation of Pen fields.
Error: <i>Query Name</i> : Initialization fail	Before loading query data, an E3Chart must have information about what fields are available on its query, to perform a link between these fields and the XField and YField properties. Thus, a failure occurred when retrieving these fields, which might be a network or SQL syntax error.
Error: Field not found (XField = ' <i>Field Name</i> ')	The field informed in the XField property was not found on this query. Check if this field is selected on query's edition screen, or on SQL code.
Error: Field not found (YField = ' <i>Field Name</i> ')	The field informed in the YField property was not found on the query. Check if this field is selected on query's edition screen, or on SQL code.
Error: ' <i>Query Name</i> ' ' <i>Error Message</i> '	Indicates that there is an error on this query, and data cannot be retrieved. Possible messages displayed in <i>Error Message</i> are described on the table below.
Info: <i>n</i> pts	Displays the total amount of points on the historical part.
Info: loading	Indicates that query data is still loading from a server.
Error: Invalid query (QueryName = ' <i>Query Name</i> ')	The query indicated by Pen's QueryName property was not found by this E3Chart.

Specific messages for query failures

MESSAGE	MEANING
Failed when adding data	Cannot load data into memory.
Failure when creating query	Cannot create a query.
Error when executing query	Cannot execute a query.

MESSAGE	MEANING
Failure when retrieving data from server	Cannot retrieve query results from a server.
Failure when retrieving number of records from server	Cannot retrieve query's total amount of existing records from a server.
Failure when positioning cursor at the beginning	Cannot move cursor to the first query record.
Cursor is busy	Query records are not available for retrieval from a server.
Failure when retrieving data from server	Cannot retrieve query records from a server.
Unknown error	There was an unexpected error when retrieving query data from a server.

A playback tool aims to facilitate post-operations, specially analyzing occurrences. Its need is justified because it allows users to view variations of events and analog points in real time, by using its monitoring screens in a past time, which can be, in some cases, complicated only by observing reports on events and analog values.

It is important to notice that a playback is a tool that permits an expert operator that knows the process to clearly interpret facts. It is not the scope of a playback to automatically identify a solution or a cause of an occurrence.

A practical example of playback usage may be the following:

*A user, when starting his working shift, is informed of a severe occurrence that happened at night, around 3:15AM. Then this user can open on a playback tool a screen that contains the point that generated this event and other related points, just by moving a clock to 3:10AM and clicking **Play**. When observing an animated screen with historical data, this user easily monitors the general status of this process, by moving back and forth freely in time until a perfect understanding of what caused that occurrence.*

20.1 E3Playback Object

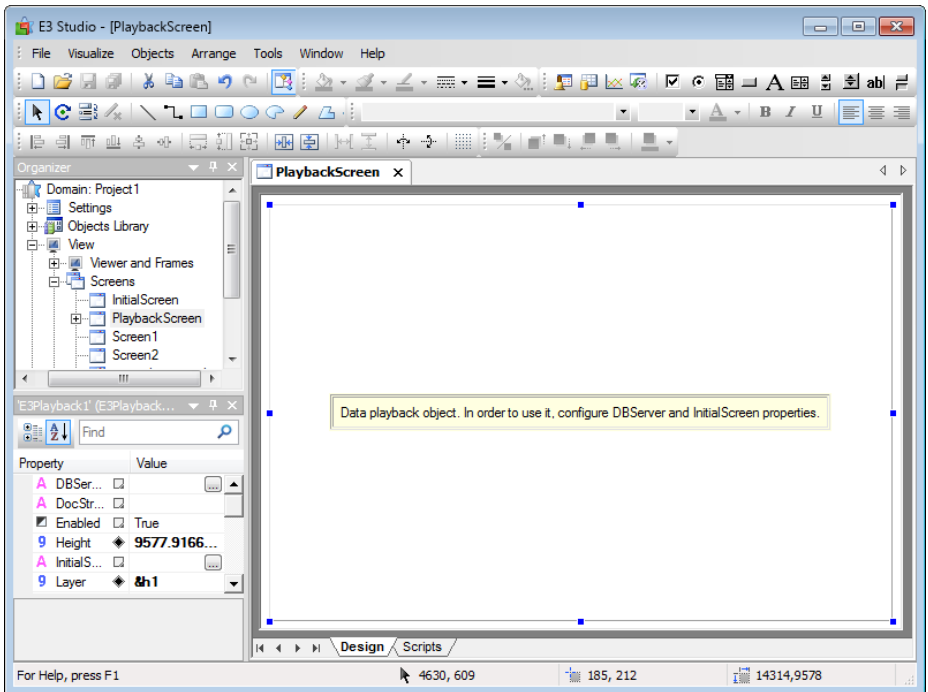
An **E3Playback**, the playback tool by Elipse, is an ActiveX that runs inside E3 Viewer or E3WebViewer and allows viewing application Screens using historical data stored on databases.

E3Playback retrieves Tags referenced on these Screens from a database, as well as other links between a Viewer and a server (such as Viewer Tags with links to server objects), and displays values, animations, statuses, and charts according to information available on a database and a defined period of playback.

20.2 Adding Playback to E3 Demo

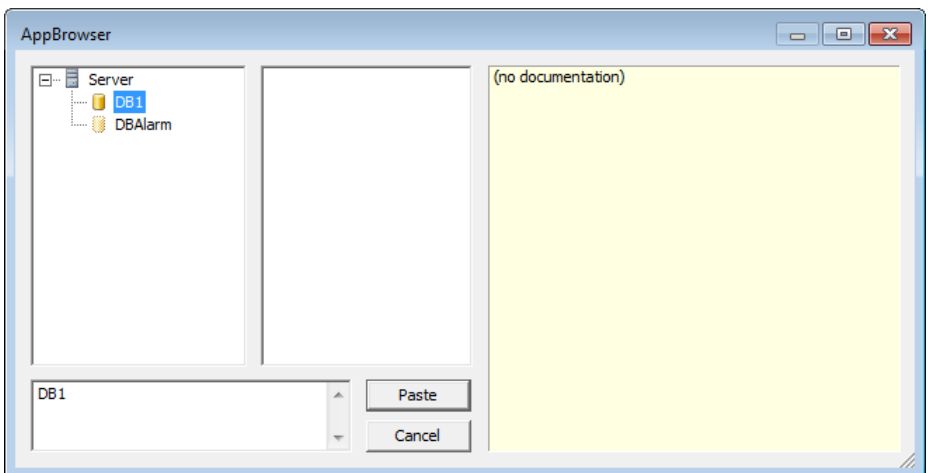
This example shows how to add a playback functionality to the demonstration application installed with E3.

1. Create a new Screen, named "PlaybackScreen", and insert an E3Playback ActiveX, filling the whole Screen's background area.



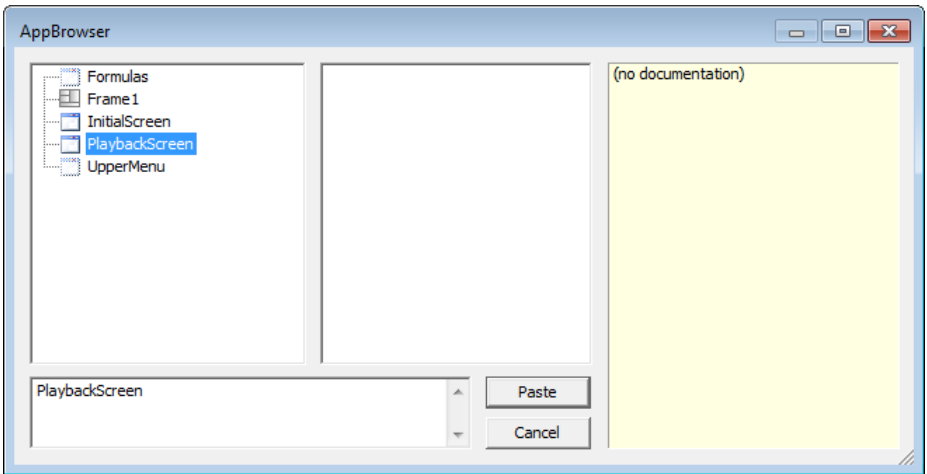
Including an E3Playback on a Screen

- Go to the Properties list and configure E3Playback's **DBServer** property to point to a Database object that contains application's historical data.



Selecting a Database

- Go to the Properties list and configure E3Playback's **InitialScreen** property to point to "FrameApp" Frame.

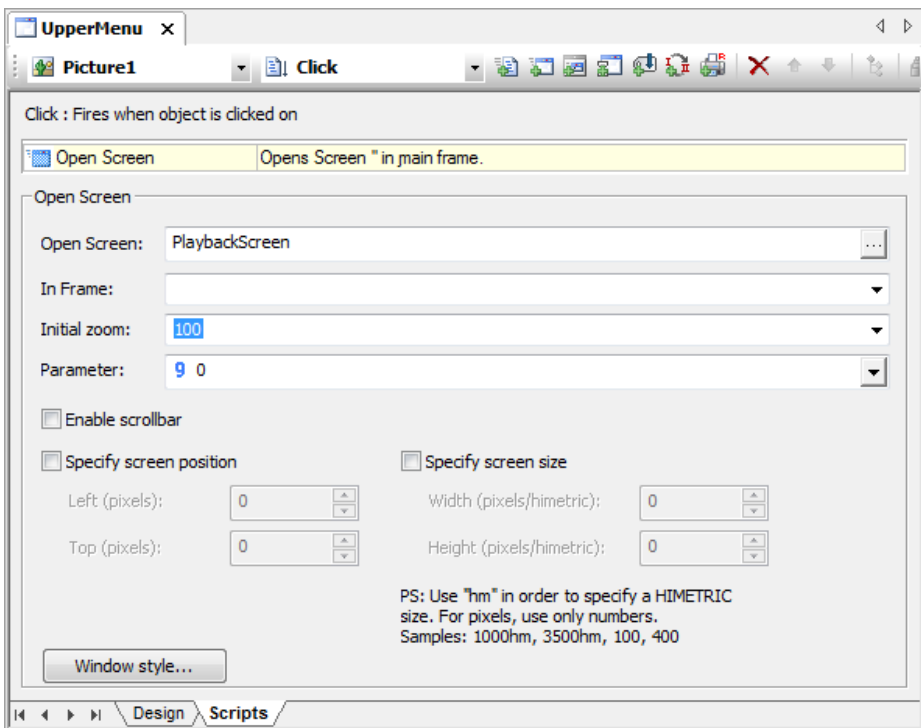


Selecting a Frame for InitialScreen property

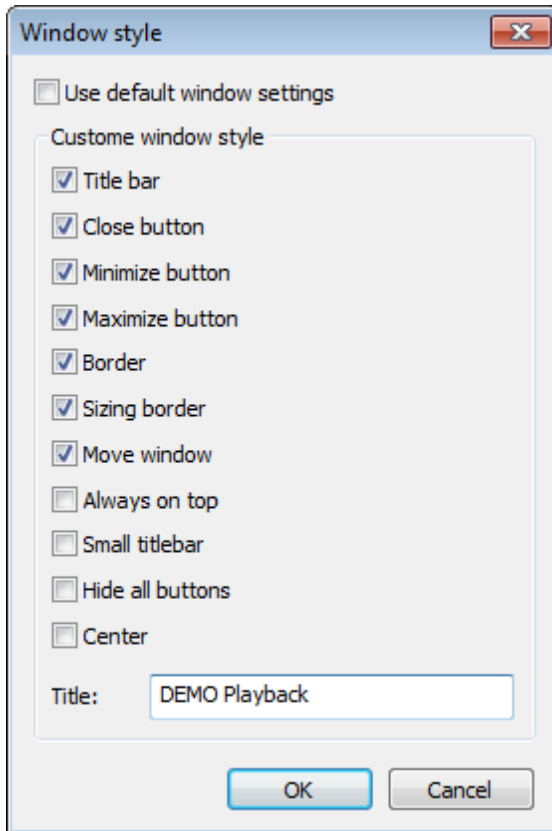
4. Open the "UpperMenu" Screen and insert a Stopwatch image on the right upper side (open the Gallery and select the **Misc Symbols 1** category).



5. Double-click the Stopwatch, add an **Open Screen** Pick on the **Click** event to open "PlaybackScreen" on the main Frame, and then configure it as in the next figures.

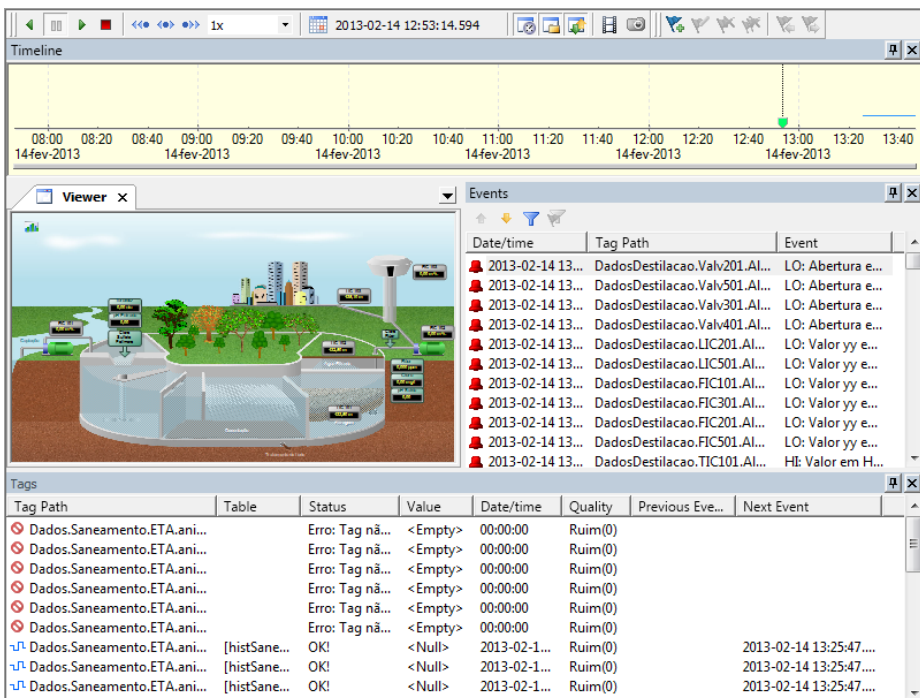


Open Screen Pick



Window style configurations

6. Execute this application, open Viewer, click **English**, then **Application Preview**, and finally click the **Stopwatch** icon. Then, the playback Screen should be displayed.



Playback screen in Online mode

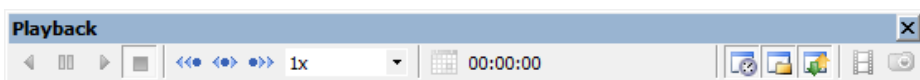
20.3 User Interface

E3Playback's user interface is divided into six parts:

- **Toolbar**
- **Timeline**
- **Bookmarks**
- **Screen Area**
- **Event List**
- **Tag List**

20.3.1 Toolbar











Playback toolbar gathers all main commands to operate an E3Playback.







Playback toolbar

This toolbar contains the options described on the next table.

Available options for Playback Toolbar

ICON	COMMAND	ACTION
	Play (backward)	Starts playing data at the current playback time, moving the clock back according to the current playback speed.
	Pause	Freezes playback clock at the current time.
	Play	Starts playing data at the current playback time, moving the clock forward according to the current playback speed.
	Stop	Interrupts playback, data Tags and alarms are removed from Screens, and no new query is performed on its database.
	Slower	Slows down playback speed in half. Minimum value is 1/1024x, that is, moves forward approximately one millisecond of data at every second.
	Normal Speed	Sets playback speed to its normal value (1x).
	Faster	Doubles playback speed. Maximum value is 1024x, that is, at every second playback clock moves forward 1024 seconds (approximately 17 minutes).
	Speed Selector	Allows selecting playback speed.
	Current Date and Time	Displays current playback clock's date and time, and allows selecting a new date.
	Show or hide Timeline	Shows or hides E3Playback's Timeline window.

ICON	COMMAND	ACTION
	Show or hide Tag List	Shows or hides E3Playback's Tag window.
	Show or hide Event List	Shows or hides E3Playback's Event window.
	Start or stop video recording	Allows generating a video (in AVI format) capturing the entire playback area during a certain period of time, or until users stop recording.
	Capture E3Playback screen	Allows capturing playback Screen area. Captured Screens can be saved to a BMP file or copied to the Clipboard.

When selecting the **Video Recording** tool , the window on the next figure is then displayed.

Recording options

Save video as:

C:\Users\vm_screenshot_win7\Documents\Playback001.avi

...

Maximum recording time

☒ Undefined
 ☐ Time (s):

60

Frames per second:

25

☐ Show mouse cursor in recording

Video compression

Compressor:

Microsoft Video 1

Compression quality:

70

Frame interval for each keyframe:

200

Configure...

About...

Audio compression

☐ Record audio

Device:

Microfone (Dispositivo de High

Format:

PCM

Attributes:

22,050 kHz; 8 Bit; Mono

Configure...

☒ Show summary when finish recording


Record

Cancel

Recording options window

The available options are described on the following table.

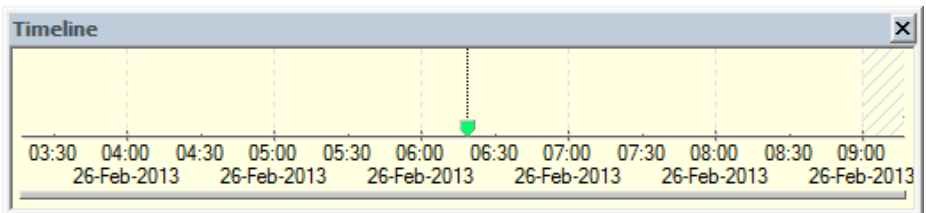
Available options for Recording options window

OPTION	DESCRIPTION
Save video as	Displays path and name of a video file to save. Click  to browse computer folders.
Maximum recording time	Allows defining a total recording time. If it is set to Undefined , recording only stops if E3Playback video recording option is clicked. The Time (s) option allows predefining a maximum recording time, in seconds (in this case recording is automatically stopped at the end of the selected time).
Frames per second	Configures the number of frames captured at every second of this recording process.

OPTION	DESCRIPTION
Show mouse cursor in recording	When this option is enabled, the mouse pointer appears in the recorded video. Default value for this option is disabled. The recorded mouse pointer in this video is the one configured as Windows default. Animated mouse pointers are not animated in this video. In this case, the first frame of this animation is always displayed.
Compressor	Video compressor used on the recording process. All compressors installed on the computer are listed, if supported by E3Playback.
Compression quality	Configures compression rate, which affects the final quality of this video, and therefore the size of the resulting file.
Frame interval at each keyframe	Configures the number of frames at each key frame.
Configure (compressor)	Opens a new window with specific settings of the selected compressor.
About	Opens a new window with information about the selected compressor.
Record audio	Enables audio recording. Default value of this option is disabled.
Device	Lists all audio devices installed and enabled on the computer that can be used on audio recording.
Format	Displays information about the audio format currently selected.
Attributes	Displays information about attributes of the currently selected audio format.
Configure (audio)	Displays a window allowing to change the recording format and audio attributes.
Show summary when finish recording	Enables or disables a window displayed when the recording process is finished.

20.3.2 Timeline

A **Timeline** allows visually tracking down and controlling playback clock.



Timeline

Options for this component are described on the following table.

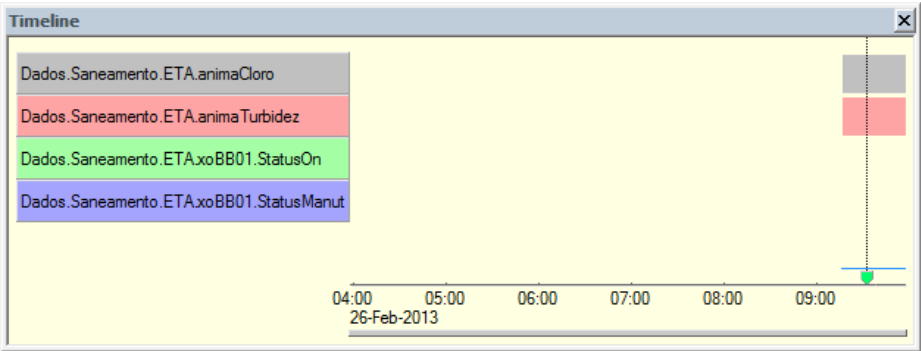
Available options for Timeline

OPTION	DESCRIPTION
Ruler	Displays a time line. Users can move this time line from side to side by clicking and dragging the mouse. Zoom is controlled by the mouse wheel. Moving it up is equivalent to zooming in. Moving it down is equivalent to zooming out. Users must first click time line background before trying to zoom in or out. When pressing the CTRL key, a zoom operation is performed three times faster.
Cursor	Marks the current position of playback clock. When playback is in Pause mode, users can drag the cursor from side to side, changing playback clock while dragging the cursor. It is always visible on the time line.
Query Bar	Displays periods of time that already have loaded data: <ul style="list-style-type: none">• A light green line means that, on this period, data is fully loaded• A dark green line indicates that data of this period is currently loading• A light yellow line indicates that this period contains some loaded data. New database queries are needed if the cursor is moved over that period• A light gray line indicates that the period has no loaded data yet. To load data from that period, move playback cursor over it
Data Bar	Indicates with a blue dot each moment when there is a playback event.
General Zoom Bar	Displays the period of data currently displayed on the Timeline, compared to the total period of data available for playback.

In case a Tag's **Display chart in Timeline** option is selected in **Event List** or **Tag List**, a visual representation of this Tag is displayed on the left side of the chart. This representation varies according to Tag's data type:

- **String**: Displays text boxes with Tag names
- **Boolean or Digital**: Displays a status chart of a Tag, where Tag value is drawn over a bottom line (Off or False) or over a top line (On or True). Chart line is dotted on periods where Tag quality is bad

- **Double, Integer, or Analog:** Displays a line chart with Tag values. Chart scale (bottom and top) is calculated automatically according to Tag values already retrieved by E3Playback on a database. As in a digital chart, chart line is dotted on periods where Tag quality is bad. This line can be interpolated or in steps, depending on Tag supporting (Storage) or not (Historic) interpolation



Display chart in Timeline

Every Tag added to Timeline has an automatically defined color, which can be changed by using the **Change color** option on the contextual menu. This option opens the system's color dialog box, allowing to select a new color or customize the selected color.

20.3.3 Bookmarks



Bookmarks are used to highlight occurrences on E3Playback's time line.





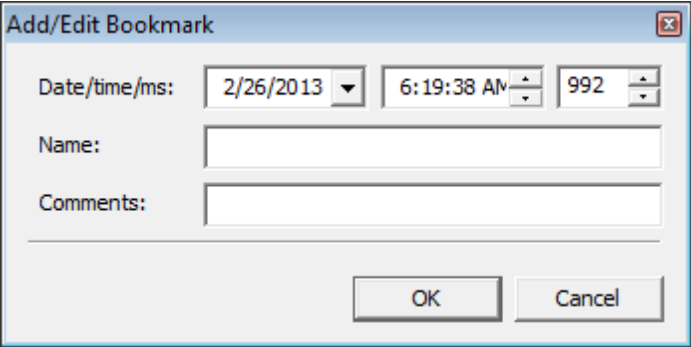
Bookmarks

Available options for Bookmarks toolbar

ICON	COMMAND	ACTION
	Adds a bookmark on the selected timestamp	Adds a name to a bookmark on the time line, at the selected date and time.
	Edits the selected bookmark	Allows editing the selected bookmark, also changing date and time, name, or description.
	Removes the bookmark	Removes the selected bookmark from time line.
	Removes all bookmarks	Removes all bookmarks created on time line.

ICON	COMMAND	ACTION
	Moves to the previous bookmark	Selects a bookmark immediately ahead on time line and on event list, simultaneously.
	Moves to the next bookmark	Selects the next bookmark on time line and on event list, simultaneously.

By clicking  **Add** or  **Edit**, the following window is then displayed.



The image shows a dialog box titled "Add/Edit Bookmark". It contains three input fields: "Date/time/ms" with a date of 2/26/2013, a time of 6:19:38 AM, and a millisecond value of 992. Below these are "Name:" and "Comments:" text boxes. At the bottom right are "OK" and "Cancel" buttons.

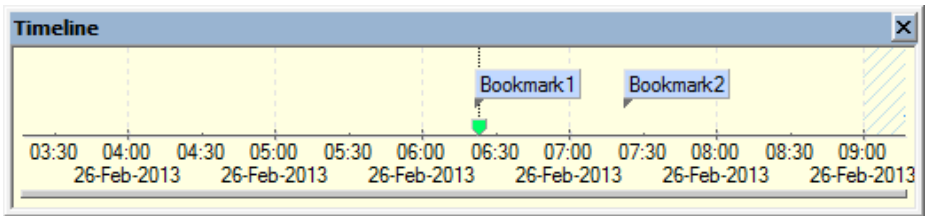
Add or edit bookmark

The available options on this window are described on the next table.

Available options for Add or Edit Bookmark window

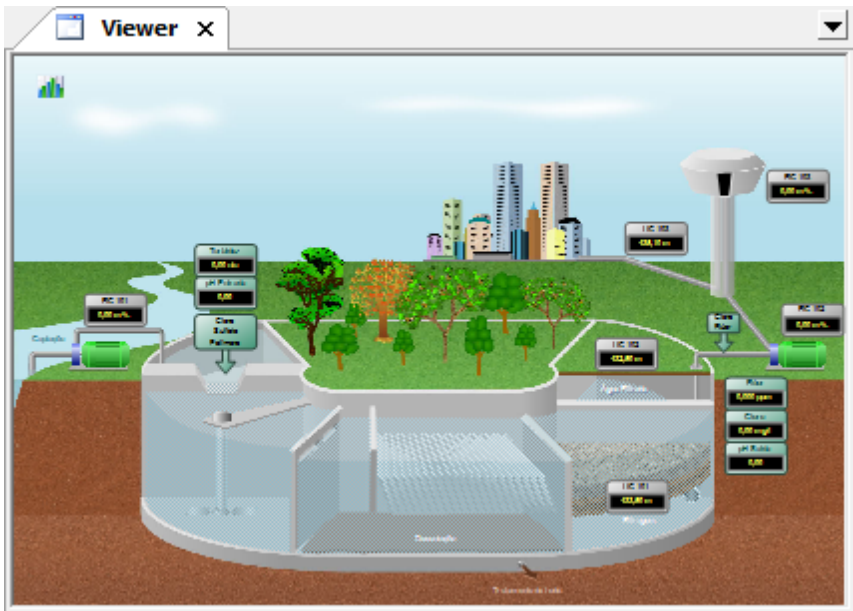
OPTION	DESCRIPTION
Date/time/ms	Allows selecting bookmark's date and time, including milliseconds. These fields are already filled in with the selected date and time on time line.
Name	Allows selecting bookmark's name.
Comments	Allows informing an additional comment for this bookmark.

When creating a bookmark, it is displayed on **Timeline**, as in the next figure, and also on **Event List**.



20.3.4 Screen Area

This is the area where application Screens are displayed. The Screen initially displayed is the one configured in E3Playback's **InitialScreen** property. If this property is left blank, then Viewer's initial Screen is used.



Screen Area

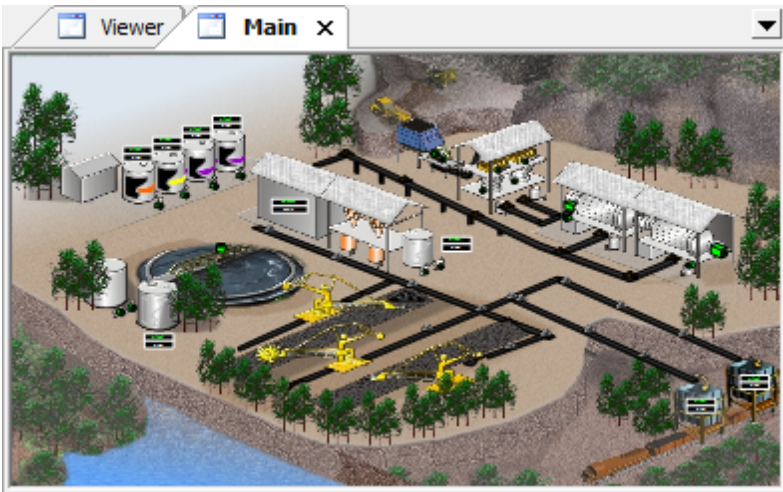
A Screen Area works as a Viewer inside E3Playback. Screens are always opened in **Fit** zoom. It is possible to freely browse application Screens.

There are some restrictions and comments regarding Screen behavior inside E3Playback:

- Screens work as if they were inside a Read-Only Viewer, that is, it is not allowed to send commands and values to an E3 Server. This guarantees that operations performed on E3Playback do not interfere with an application in real time
- It is not allowed to access server objects using the **Application.GetObject**

method. If this method is called in a script, it fails by aborting this script

- Due to several access limitations to a server, script errors occurred inside E3Playback do not generate an error message, and scripts are silently aborted
- E3Playback emulates a real Viewer. To do so, a new copy of a Viewer object and its Tags are created for use with E3Playback. If any specific Viewer behavior must be enabled or disabled inside E3Playback, users can test Viewer's **IsPlaybackMode** property
- There is a complete isolation among Screens running inside an E3Playback and what is outside
- E3Playback handles new Frames created by an application as new tabs on top of Screen Area. Tab's title is the name of the Frame or Screen that was opened



Frames opened on E3Playback tabs

- All Links referring to server objects are captured by an E3Playback, and start receiving historical data according to the current playback clock. This includes not only Links created on displayed Screens, but also on Links available on Viewer Tags
- Links created among Viewer objects (for example, a Display showing a Demo Tag value internal to the Viewer) work normally, without any playback interference
- E3Chart only works inside an E3Playback if it is configured with historical Pens. Real-time Pens are disabled inside E3Playback (they do not receive any data)
- E3Alarm displays an alarm summary according to what is stored on

database's alarm table

- E3Browser works normally, because database queries are allowed inside an E3Playback

NOTE: Data displayed on an E3Browser are always the **CURRENT** data from a database, that is, an E3Playback does not try to emulate a database status at a period of time in the past.

20.3.5 Event List

An **Event List** displays a chronological sequence of playback events, which allows an event-by-event browsing. A playback event can be:

- A change on a Tag value
- A change on an alarm status

Date/time	Tag Path	Event
2013-02-26 06:21:35.707	Bookmark1	
2013-02-26 07:22:18.583	Bookmark2	
2013-02-26 09:16:42.727	DadosDestilacao.Valv201.Alarmes....	LO: Abertura e...
2013-02-26 09:16:42.742	DadosDestilacao.Valv501.Alarmes....	LO: Abertura e...
2013-02-26 09:16:42.742	DadosDestilacao.Valv401.Alarmes....	LO: Abertura e...
2013-02-26 09:16:42.742	DadosDestilacao.Valv301.Alarmes....	LO: Abertura e...
2013-02-26 09:16:42.758	DadosDestilacao.TIC301.Alarmes....	HI: Valor em H...
2013-02-26 09:16:42.758	DadosDestilacao.TIC101.Alarmes....	HI: Valor em H...

Event List

Columns on this list are described on the next table.





Columns of Event List

COLUMN	DESCRIPTION
Date/time	Displays this event's date and time, as stored on the database.
Tag Path	Displays the Tag or alarm source that generated this event, or the Bookmark's name.

COLUMN	DESCRIPTION
Event	If this event is a change on a Tag value, displays this new value. If quality is not Good (192), it is displayed before the value (for example, "Bad(20); 45.433"). If this event is a change on an alarm status, displays the sub-condition's name (HI , HIHI , LO , LOLO , etc.) and alarm's description. If this alarm is (or was) acknowledged, displays an "ACK" text at the beginning, with the operator's name inside parentheses. If it is a Bookmark, this field displays its associated comment.

Event List toolbar contains the operations listed on the next table.

Options for Event List toolbar

ICON	COMMAND	ACTION
	Previous Event	Places playback clock at an event previous to the selected one on this list, skipping events with a time stamp equal to the current time stamp.
	Next Event	Places playback clock at the next event with time stamp greater than the current time stamp.
	Filter Events	Turns an event filter on or off. When turning a filter on, only events from the current selected Tag or alarm source are displayed on the event list. Bookmarks are always displayed, even if a filter is on.
	Filter bookmarks	Displays only bookmarks that were created.

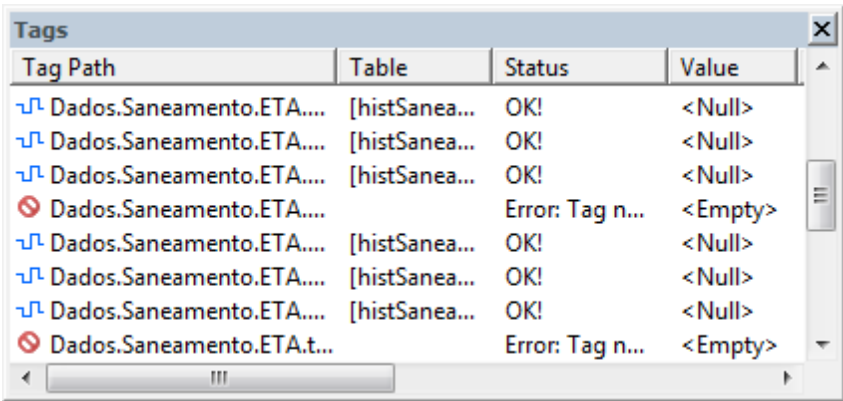
When right-clicking an event, a contextual menu is displayed with the options described on the next table.

Options for event's contextual menu

OPTION	DESCRIPTION
Show or Remove chart on Timeline	Adds or removes a visual representation of this Tag on the Timeline window.
Show only events from this tag or Show all events	Filters events displayed on the Event list to display only the selected Tag. Selecting this option again displays all events.

20.3.6 Tag List

A **Tag List** displays Tags currently in use for playback.



Tag Path	Table	Status	Value
↗ Dados.Saneamento.ETA....	[histSanea...	OK!	<Null>
↗ Dados.Saneamento.ETA....	[histSanea...	OK!	<Null>
↗ Dados.Saneamento.ETA....	[histSanea...	OK!	<Null>
⊗ Dados.Saneamento.ETA....		Error: Tag n...	<Empty>
↗ Dados.Saneamento.ETA....	[histSanea...	OK!	<Null>
↗ Dados.Saneamento.ETA....	[histSanea...	OK!	<Null>
↗ Dados.Saneamento.ETA....	[histSanea...	OK!	<Null>
⊗ Dados.Saneamento.ETA.t...		Error: Tag n...	<Empty>


Tag List


Columns on this window are described on the next table.

Columns on Tag List

COLUMN	DESCRIPTION
Tag Path	Displays Tag's path.
Table	Displays the name of a database's table that contains Tag data.
Status	Indicates whether this Tag was found on the database.
Value	Displays Tag's value on the current playback date and time.
Date/time	Displays Tag's current time stamp. If this Tag supports interpolation (only for analog points stored on a Storage), then the time stamp is equal to the current playback time. If not, the time stamp is from the last event with a time stamp less or equal to the current playback time.

COLUMN	DESCRIPTION
Quality	Displays Tag's quality (OPC standard) on the current playback time. When quality is equal to 192, displays only a "Good" text.
Previous Event	Displays the time stamp of the previous event of this Tag on the database. If this Tag does not support interpolation, the previous event is always equal to Tag's current time stamp. If this Tag supports interpolation, the previous event is the last time stamp stored on the database before the current playback time.
Next Event	Displays the time stamp of the next event of this Tag.

NOTE: A Tag List can also help to determine which Tags need to be written to a database, to allow a full playback of a Screen, by simply checking Tags with a forbidden  icon.

When right-clicking a Tag, a contextual menu is then displayed with the same options described on topic **Event List**, except in case of Tags marked with the  icon, in which this contextual menu appears disabled.

20.4 Playback Database

An E3Playback automatically detects which Tags and alarms are stored on a database. This process of detecting a database is known as **Assembling**. After a database is assembled, E3Playback uses this collected information to query stored data, according to Tags displayed on Screen, and according to the current playback clock.

20.4.1 Database Assembling

A **Database Assembling** is always performed when an E3Playback is activated. Information about database structure collected during this assembling process is kept while the playback section is active. The steps of a database assembling process can be summarized as:

1. Enumerate all database tables.
2. Check which one of these tables have the corresponding `_Fields` table. For example, when E3 generates an alarm table named `E3Alarms`, and also generates a table with a description of fields on the alarm table (`E3Alarm_Fields`).
3. Analyze fields from each table, as well as the contents of its corresponding `_Fields` table to determine a table type. An E3Playback recognizes three types of

tables:

- **Storage:** This table must have **E3TimeStamp**, **FieldID**, **Quality**, and **FieldValue** fields
 - **Alarms:** This table must have **EventTime** (or **EventTimeDbf**), **ConditionActive**, **Acked**, **AckRequired**, and **FullAlarmSourceName** fields
 - **Historic:** This table must have **E3TimeStamp** field, and must not be recognized as a Storage or Alarms table
4. If this table is a **Storage**-type, the **_Fields** table is scanned to determine which Tags are stored on it. A Tag path is determined by table's **FieldName** field. The field that provides time stamp data is always **E3TimeStamp**. Each Storage can have up to three data tables, one for each data type:
 - **Strings:** Table name is <Table>_String
 - **Bit/Digital:** Table name is <Table>_Bit
 - **Double/Analog:** Table name is <Table>
 5. If this table is a **Historic**-type, the **_Fields** table is scanned to determine which Tags are stored on it. A Tag path on this case is determined by table's **FieldSource** field. The field that provides times tamp data is always **E3TimeStamp**.
 6. If this table is an **Alarm**-type, the **_Fields** table is scanned to determine user's alarm field names (if they exist). The field that provides time stamp data is **EventTime** (optionally combined with **EventTimeMS** field, if it exists) or **EventTimeDbf** field (this last one has priority because it represents milliseconds with higher precision).
 7. After all data tables and Tag paths are detected, a simple query is then performed on each one of these tables to determine the oldest and newest date stored on this table. This allows determining date intervals where playback is allowed.

NOTE 1: A valid date interval is not updated during a playback process, then new data added to a database after a database assembling process is only available if playback window is closed and opened again.

NOTE 2: In **Demo** mode (or with an E3 Studio license), the allowed playback period is restricted to the last six hours of data stored on a database.

20.4.2 Playback Queries

The amount of playback data available can be huge, depending on the application. For a smoother Screen browsing, E3Playback performs database queries in short periods of time, called **Slices**.

Each playback data slice has a fixed width of one day. Every time the clock is

positioned on a certain date and time, E3Playback creates or finds out the time slice that contains the current date and time. Each data slice has the following information:

- Period of time of that slice (starting and ending date and time)
- A list of Tags that already have their data loaded on that slice
- For each Tag stored on a slice, the following data is kept:
 - The last event of the Tag previous to the beginning of that slice
 - All Tag events inside that slice's interval
 - The next Tag event after that slice's ending
- The alarm summary at the moment of that slice's beginning
- All alarm events that occurred during that slice's interval
- The next alarm event of each Alarm Source after that slice's ending

When a playback clock is moved over a time slice, E3Playback analyzes if all necessary Tags are already loaded on that slice, as well as if all alarm information is already loaded. If some data is missing, then an asynchronous query is generated to load necessary data from a database. A playback query is composed of the following parameters:

- Period to search for (starting and ending date and time)
- Set of Tags to search for (this may be an empty set). For each Tag it must return:
 - The last event prior to the beginning of that query
 - All events occurred during that query's period
 - The next event that occurred after the query's period
- Alarm information that must be searched for, which is zero or more of the following options:
 - Previous alarm summary (status of each Alarm Source at the beginning of query's date and time)
 - Alarm events on that period
 - Next alarm summary (next event of each Alarm Source after the ending of that period's date and time)

To run a query on playback data, usually several database queries are needed. A playback data server performs these queries asynchronously and on a separate thread, collects data, and only returns them when all queries are finished.

When a playback query is completed, data is immediately added to its corresponding slice and E3Playback automatically triggers queries to update adjacent slices. This way, while playback clock is moving forward, data queries are performed, and when playback clock moves on to the next slice it is almost certain that it already contains all data loaded.

In case playback clock is in **Play ▶** mode and between a slice without data or with incomplete data, E3Playback remains temporarily paused waiting for queries of that slice to be completed.

E3Playback also tries to minimize database access, getting information from **Last Previous Event**, **Next Event After**, **Previous Summary**, and **Next Summary** fields to avoid querying this data again. For example:

- If a query to a Tag did not return the next event after that query's period, this means that this Tag does not have any event after that query's ending date and time, and therefore this Tag does not need to be queried on the next time slices
- If a query returned a previous summary, alarm events on that period, and the next summary for a slice, it is possible to calculate the previous summary of the next slice simply by combining the previous summary and events occurred during the current slice. This way, there is no need to query a database for the previous summary of the next slice

20.5 Configuring E3 Database Objects

This section explains how E3 objects must be configured so that data stored on a database can be used by an E3Playback.

20.5.1 Storage

The only recommendation for a Storage is that the **Source** column must not contain expressions, because they cannot be used on playback.

E3 already creates automatically on Storage tables the necessary indexes to optimize E3Playback queries.

20.5.2 Alarms

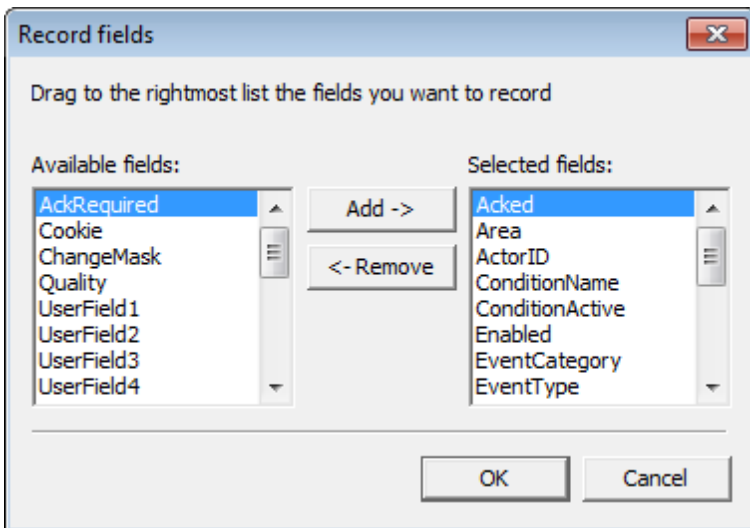
To perform an alarm playback, follow these procedures:

1. Enable or configure alarm recording on disk.
2. Select the following fields for recording (mandatory):
 - **EventTime** (plus **EventTimeMS**) or **EventTimeDbI**
 - **FullAlarmSourceName**
 - **ConditionActive**

- **Acked**
- **AckRequired**

3. It is also recommended to select the following fields for recording:

- **InTime** (plus **InTimeMS**) or **InTimeDbI**
- **OutTime** (plus **OutTimeMS**) or **OutTimeDbI**
- **AckTime** (plus **AckTimeMS**) or **AckTimeDbI**
- **Area**
- **ActorID**
- **Enabled**
- **EventCategory**
- **EventType**
- **Message**
- **Severity**
- **Source**
- **SubConditionName**
- **CurrentValue**



Selecting fields

E3 automatically creates on alarm tables the necessary indexes to optimize playback queries.

20.5.3 Historics

The Historic's file format is not appropriate for playback, because normally many duplicated data is stored. Playback queries have an extra work to eliminate duplicated data from each Tag and find out only value-changing events, which may demand long sequential queries on a Historic table. It is recommended to use a Storage whenever possible. If Historic data is indispensable on playback, users must follow these recommendations:

- Configure the **UserTable** property to False (if this property remains in True, the **_Fields** table of this Historic is not generated, and this Historic is not recognized by playback)
- Place each Tag on a separate field (do not use expressions on field's source, for example)
- Create an index for **E3TimeStamp** field. Without this index, Historic queries get slow, turning playback impracticable
- Use tables with a few fields and, if possible, add an individual index for each field (mainly for fields with little variation)
- Configure the **CompressedTable** property to True and use the **DeadBand** property on this Historic

The next figure shows how to configure an **E3TimeStamp** field index.

Add Index

Index Definition

Index name:

☐ The index fields contain unique data.

Select the fields used in this index:

Field Name	Order	Type
<input type="checkbox"/> E3TimeStamp	0 - Ascending	3 - fdDateTime
<input type="checkbox"/> Field	0 - Ascending	1 - fdInteger
<input type="checkbox"/> Field2	0 - Ascending	1 - fdInteger
<input type="checkbox"/> Field3	0 - Ascending	1 - fdInteger
<input type="checkbox"/> Field4	0 - Ascending	1 - fdInteger

Change field order:

Index definition for an E3TimeStamp field

20.5.4 Licensing

Eclipse Software provides two playback packages, according to its tools:

- **Basic Playback**
- **Advanced Playback:** It is **Basic Playback** plus **Video Recording** and **Screen Capture** tools

Each one of these packages is dimensioned according to the number of points (Tags and Alarm Sources) stored on a database. For example, a **Basic Playback 1000** allows performing a playback on a database with up to 1,000 points. If a database has more points than the available licenses, a database assembling process fails and an error message is then displayed, indicating that there are no available licenses to execute a playback.

An E3 Studio license includes an **Advanced Playback** license with no limit on points, although it is limited to the last six hours of data stored on a database. This allows an application developer to test playback without purchasing licenses for this.

In **Demo** mode (when there is no protection device), playback also works in **Advanced** mode without a limitation on points, although limited to display only the last six hours of data stored on a database, relative to the current server time.

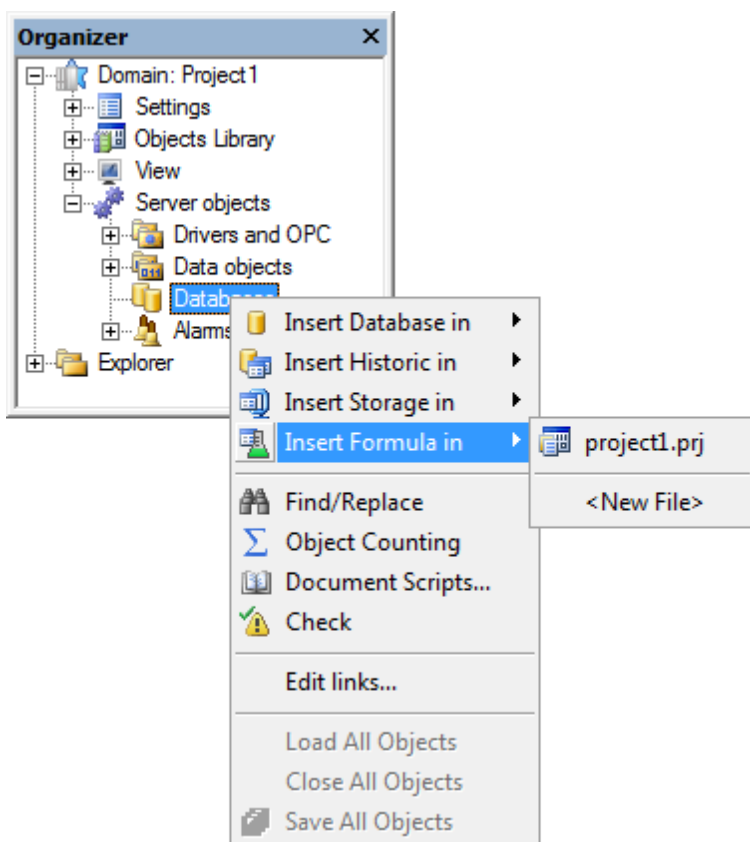
IMPORTANT: If a protection device is a **Master- (Studio + Runtime)** or **Runtime only**-type, playback is only available if there are licenses programmed on this protection device. For more information about limitations of E3's **Demo** mode, please check the topic **Limitations of Demonstration Mode**.

Formulas are modules that store and transfer sets of values to specific groups of variables, to create predefined settings. They are composed of three parts:

Templates, **Units**, and **Value Sets**.

Users can use Formulas to make industrial processes easier. For example, a beverage factory makes several types of juice, and each type has a different recipe. In this case, **Templates** represent juice flavors (orange, grape, tangerine, etc.). **Units** represent tanks where this juice is produced. **Value Sets** are the type and amount of products in each juice (for example, 50g of sugar, 1500l of water, fruit pulp, etc.). To use this feature, follow this procedure:

1. Right-click the project's name in Explorer, and select the **Insert - Formula** option. In **Domain** mode, right-click the **Server objects - Databases** item, select the **Insert Formula in** item, and then the project's name.

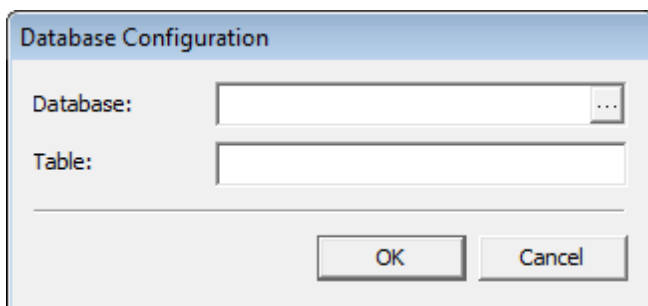


Inserting a Formula

NOTE: A Formula object can be configured to work as an **Alarm Area**.

21.1 Settings

When creating a Formula, a window for configuring a Database and a table to use is displayed. Without it, it is not possible to create Units and Value Sets.



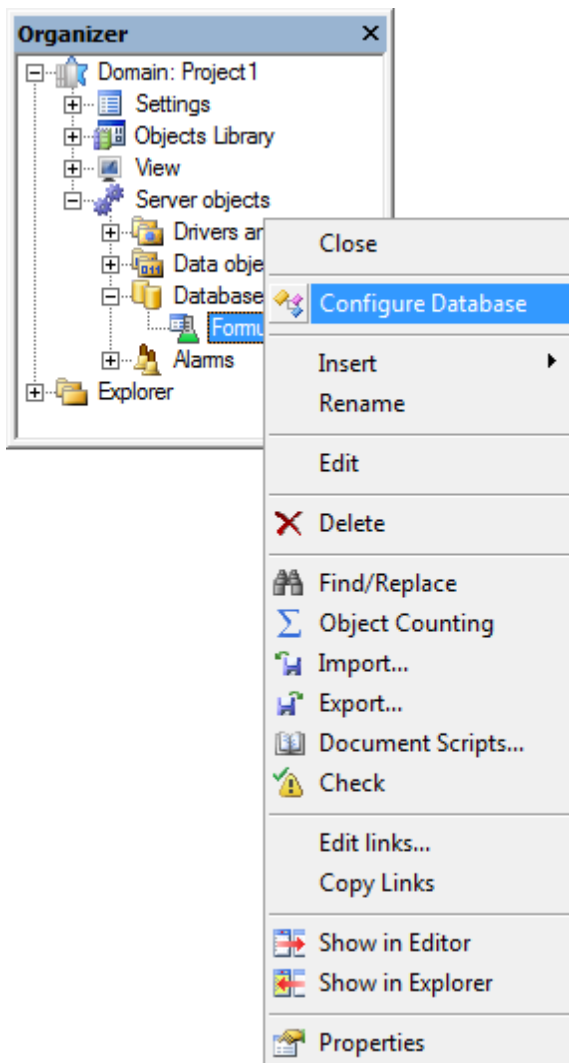
Database and table configuration window

The available options are described on the next table.

Available options for Database Configuration window

OPTION	DESCRIPTION
Database	Specifies a Database Server that manages data configured in this Formula.
Table	Specifies a table's name.

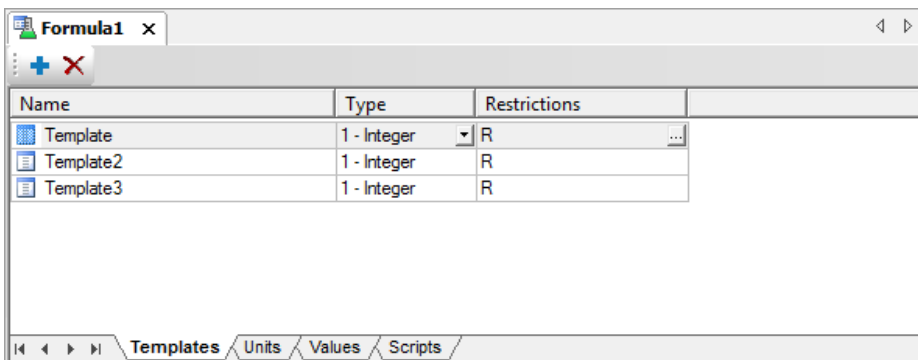
If there is a need to configure these items later, or even reconfigure them, select the **Configure Database** option on Formula's contextual menu.



Configuring a Database

21.2 Templates

The first tab on Formula's view is called **Templates**. Templates define which data types can be stored in each Formula's variable and their restrictions.






Templates tab

The available options on this tab are described on the next table.

Available options for Templates tab

OPTION	DESCRIPTION
Name	Defines Template's name
Type	Defines Template's type
Restrictions	Determines Template's restrictions

The toolbar on Template's view contains the following options: **Add** , to create a new Template, and **Remove** , to delete the selected Template.

When clicking **Restrictions** , the following window is then displayed.

Restriction Configuration

Restrictions define how the formula data can be modified in runtime by an operator.

Limit Type

☐ Unrestricted limit
The operator CAN modify the data.

☒ Restricted limit
The operator can NOT modify the data.

☐ Absolute limit
The operator can type values between and .

☐ Percent limit
The operator can type values between % below and % above the original value.
Ex.: If the original value is 100, setting limits to 20% and 30% will allow values in the range 80 to 130.

☐ Diff limit
Operator can type the original value minus and .

Ex.: If the original value is 100, setting limits to 10 and 50 will allow values in the range 90 to 150.

OK Cancel

Editing restrictions

Restrictions allow users to enable or disable value changes at run time or to define limits for these changes. The available options on this window are described on the next table.

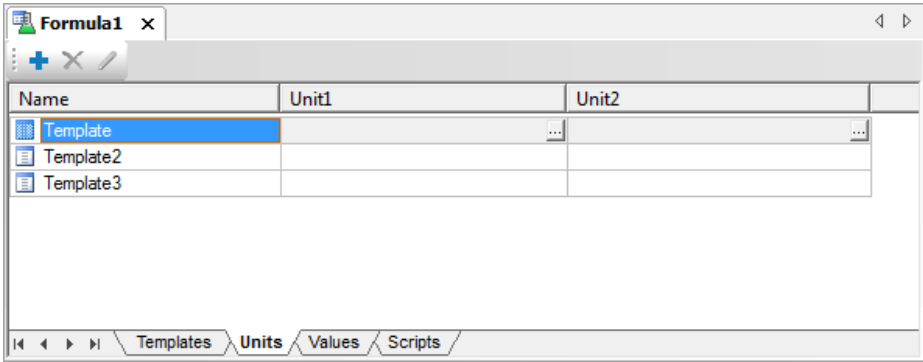
Available options for Restriction Configuration window

OPTION	DESCRIPTION
Unrestricted Limit	Users can change any value in this Template. It is represented on Template's view by the letter U .
Restricted Limit	Users cannot change Template's value. It is represented on Template's view by the letter R .
Absolute Limit	Fixed values are defined as limits, corresponding to Template's minimum and maximum values. It is represented on Template's view by the letter A (and minimum and maximum values configured in that field).

OPTION	DESCRIPTION
Percent Limit	A percentage value, above or below a predefined value. For example, by placing these limits between 20% and 30% for a value of 100, the allowed values vary between 80 and 130. It is represented on Template's view by the letter P (and the values configured in that field).
Diff limit	Fixed values above or below a predefined value. For example, by placing these limits between 10% and 50% for a value of 50, the allowed values vary between 40 and 100. It is represented on Template's view by the letter D (and the values configured in that field).

21.3 Units

The second tab on Formula's view is called **Units**. Units define Tags linked to Formula Templates. It is possible to create several Units, that is, several Tag groups that can receive Formula values.






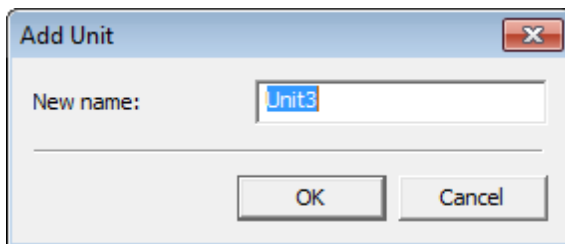
Units tab

The available options are displayed on the next table.

Available options for Units tab

OPTION	DESCRIPTION
Name	Specifies Template's name.
Unit	Specifies a Tag to link to this Unit.

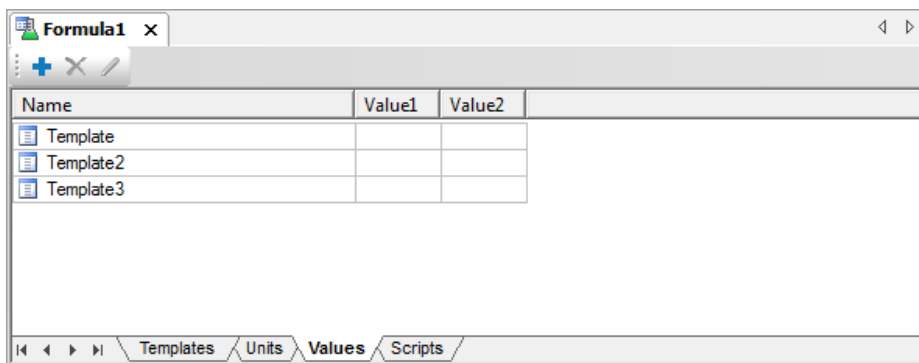
This view's toolbar has the following options: **Add** , to create a new Unit, **Remove** , to delete the selected Unit, and **Rename** , to rename the selected Unit. For each new Unit, a new name is required.



Adding a Unit

21.4 Value Sets

The third tab on Formula's view is called **Values**. Value Sets are values transferred to Tags, that is, to Units.






Values tab

The available options are described on the next table.

Available options for Values tab

OPTION	DESCRIPTION
Name	Determines Template's name.
Value	Determines field values for Value Sets.

This view's toolbar has the following options: **Add** , to create a new Value Set, **Remove** , to delete the selected Value Set, and **Rename** , to rename the selected Value Set.

21.5 Creating a Formula

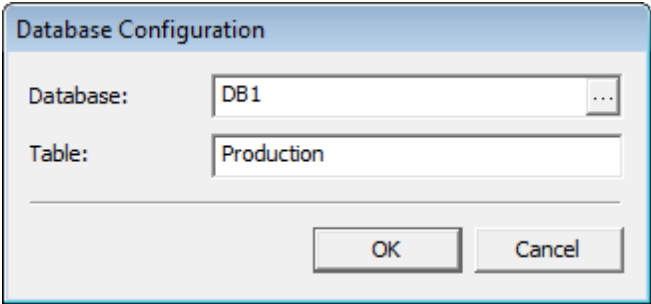
Instructions

This exercise creates a Formula object to store Value Sets to produce a certain part. This part has three measurement units: External Diameter, Internal Diameter, and Height. This Formula stores values for two different engines, which produce these

parts.

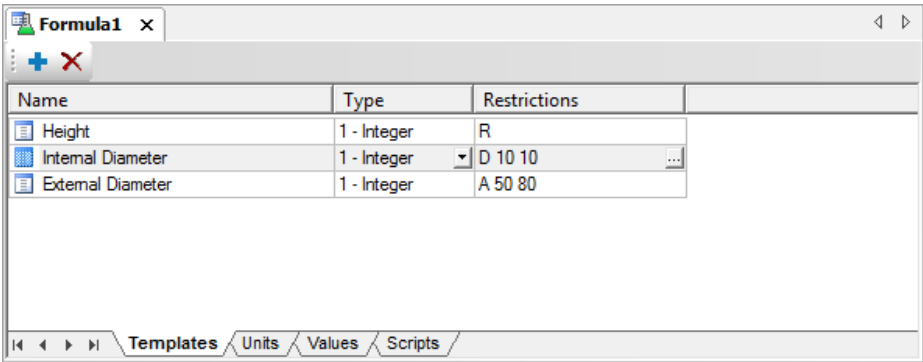
21.5.1 Procedures

1. Insert a Formula object in the application.
2. Configure a Database and a table. Use an existing Database on this project, and name this table as "Production".



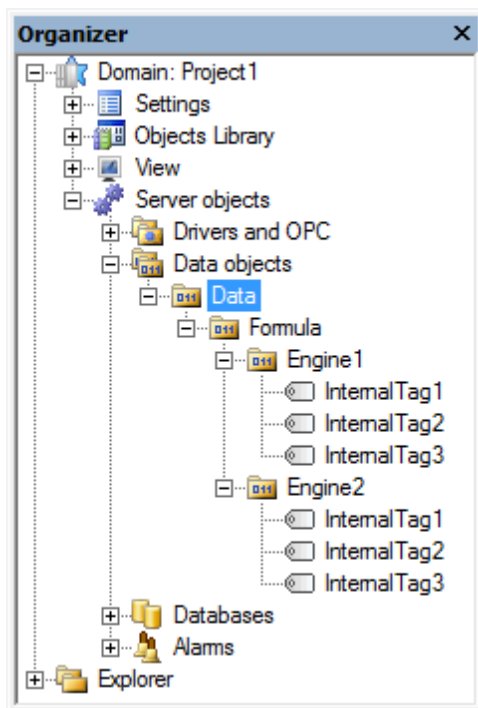
Configuring a Database and a table

3. Create three Templates in this Formula:
 - **External Diameter:** With an absolute value restriction between 50 and 80
 - **Internal Diameter:** With a difference value restriction of 10 and 10
 - **Height:** With a restricted limit



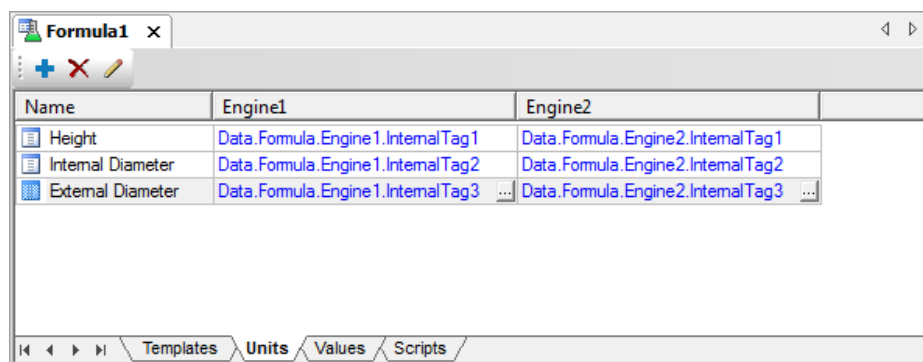
Templates

4. The next step defines Units relative to this Formula. Before creating these Units, however, users must create Tags for this Formula. To do so, insert a Folder named "Formula" in a Data Server, and inside it two other Folders named "Engine1" and "Engine2". Inside these Folders, create three Internal Tags for each one.



Creating Tags

5. Create two Units in this Formula, named "Engine1" and "Engine2". Link each field on these Units to the previously created Tags.



Linking Tags to Formula Units

6. Define all Value Sets to load later into Tags. Create four Value Sets, named from "Model1" to "Model4", and type their values as on the next figure.

Formula1					
Name	Model1	Model2	Model3	Model4	
Height	120	100	50	280	
Internal Diameter	85	80	75	100	
External Diameter	75	55	70	80	

Configuring Value Sets

7. Create a new Screen named "Formulas".
8. On this Screen, create six SetPoints to link to each Tag in this Formula, and adjust Screen size to the size of these objects. This Screen should look like the following figure.

Formula screen

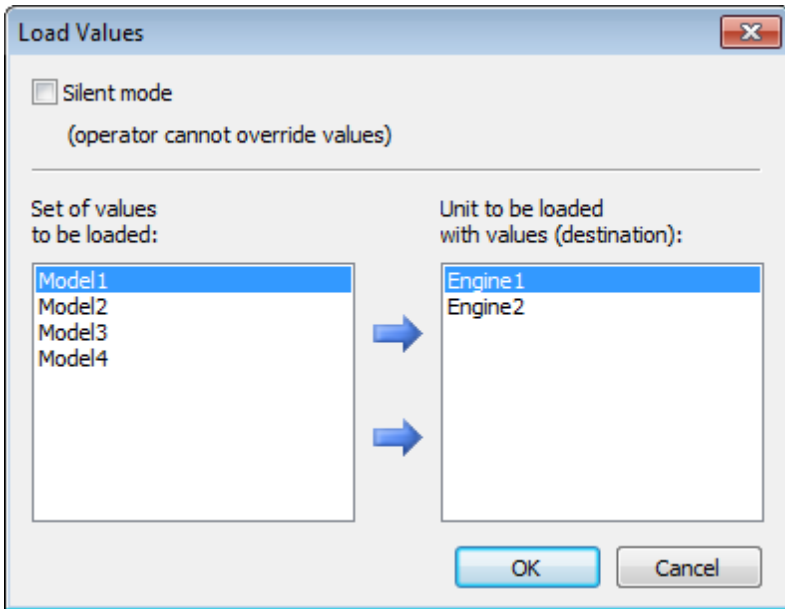
NOTE: Sometimes, an error may occur on a Screen that makes images disappear. To solve this issue, disable the **Hide MS-DOS extensions for registered files** option. This option is available in Windows Explorer.

9. Create a button on this Screen using "Load values" as its caption. This button displays a dialog box with existing values and Units to which these values can

be loaded, and users can select any option. To do so, create the following script in this button:

```
Sub CommandButton1_Click()  
    Application.LoadFormulaDlg_  
        "Formula1", "Machine1", "Machine2",_  
        "Model1", Model2, Model3, Model4"  
End Sub
```

Where *Formula1* is Formula's name and **LoadFormulaDlg** is a Viewer method. When running this method, the following dialog box is displayed.



LoadFormulaDlg method's dialog box

10. On the window to the right, there are two Units created in this Formula, as well as Value Sets. The **Silent Mode** option prevents users from overriding values saved on disk, which are loaded to Tags.
11. Using this button, users can check the application working with Formulas and Tags receiving values from disk. This is one method for loading values from a Formula, but there are also methods in which users do not need to select values or Units in a dialog box.
12. Create a SetPoint on this Screen and a button with "OK" as its caption. Along with this SetPoint, place a Label with "Model:" as its caption. Then, create this script:

```
Sub CommandButton2_Click()  
    Application.LoadFormulaValues_  
        "Formula1", "Engine1", "Model1"  
    Screen.Item("Text16").Value
```


Where *Text16* is the name of the last SetPoint inserted on this Screen. This command loads a Value Set specified in this SetPoint to *Engine1* Unit. When running, this method then searches for a Value Set on disk. If found, this method loads it according to restriction patterns defined in a Formula's Template. Fields with open restrictions may have their values changed by users. If users do not want to be warned about changing values in loaded fields, they must use the silent mode.

The image shows a 'Value Override' dialog box. It has a title bar 'Value Override'. Inside, there are three labels and their corresponding values: 'Template: Internal Diameter', 'Unit: Engine1', and 'Value set: Model1'. Below these, there is a section for 'Allowed range' with 'Minimum: 75' and 'Maximum: 95'. To the right of this is a section for 'Original value:' with a text box containing '85'. Below that is a section for 'New value:' with a text box containing '85'. At the bottom right is an 'OK' button.

A change in a value

However, there is an alternative, Viewer's **LoadFormulaValuesQuiet** method. Choose the **Silent** mode on this Screen, by using a Check Box.

1. Create a Check Box on this Screen.
2. Place a Label on it, with "Silent" as its caption.
3. Return to the **OK** button script, and change it to the following code:

```
Sub CommandButton2_Click()
    If Screen.Item("CheckBox1").Value = True Then
        Application.LoadFormulaValuesQuiet_
            "Formula1", "Engine1", "Model1"
        Application.LoadFormulaValuesQuiet_
            "Formula1", "Engine1", "Model2"
        Application.LoadFormulaValuesQuiet_
            "Formula1", "Engine1", "Model3"
        Application.LoadFormulaValuesQuiet_
            "Formula1", "Engine1", "Model4"
    Else
        Application.LoadFormulaValues_
            "Formula1", "Engine1", "Model1"
        Application.LoadFormulaValues_
            "Formula1", "Engine1", "Model2"
```

```

Application.LoadFormulaValues
    "Formula1", "Engine1", "Model3"
Application.LoadFormulaValues_
    "Formula1", "Engine1", "Model4"
End If
End Sub

```

Where *CheckBox1* is Check Box's name. This uses the **LoadFormulaValuesQuiet** method, if this object is enabled. Otherwise, the **LoadFormulaValues** method is used.

4. Repeat the previous procedures, from creating a SetPoint for items of *Engine2*, modifying required scripts. After finishing these changes, this Screen should look like the following figure.

The screenshot shows a window titled "E3 Viewer Application - Formulas". Inside, there are two identical sections for "Engine 1" and "Engine 2". Each section contains three input fields: "External Diameter", "Internal Diameter", and "Height". Below the "Internal Diameter" field in each section, there is an "OK" button and a "Quiet" checkbox. At the bottom center of the window, there is a large button labeled "Load Values".

Final Screen for this Formula

5. Execute this application and check its results.

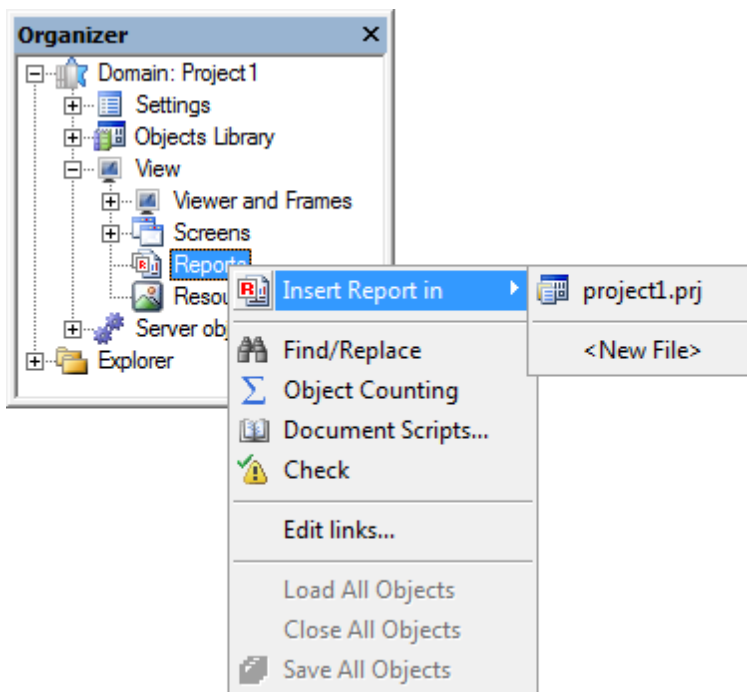
A **Report** is an ActiveX component named **ActiveReport**, which allows viewing and printing instant values of system variables and data stored on a Database (Alarms, Histories, Queries, and Formulas). This data can be printed either in text or graphical format, and this later format is performed by using an E3Chart object.

NOTES:

- The Report object **IS NOT** available on 64-bit versions of E3. However, a Report can be edited on 32-bit versions of Studio, which is available on 64-bit installations.
- A 32-bit Viewer connected to a 64-bit Server prints a Report normally.

To use a Report, follow these procedures:

1. Right-click the Organizer and select the **Insert Report in** option.



Inserting a Report

2. If needed, configure this object's properties.

22.1 Query Object

This object allows specifying database information to view on it. After creating a Report in a project, it then creates a Query object. For more information about this object, please check the **Query** chapter.

22.2 Components

A Report contains several Sections. Each Report Section contains a group of controls that are processed and printed at the same time, as a single unit.

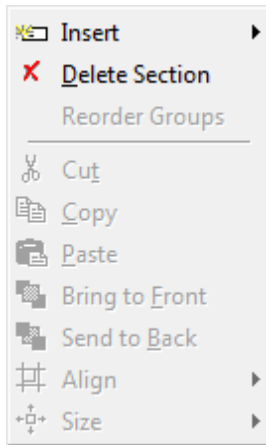


A Report defines Section types, which are explained on the next topics.

22.2.1 Header

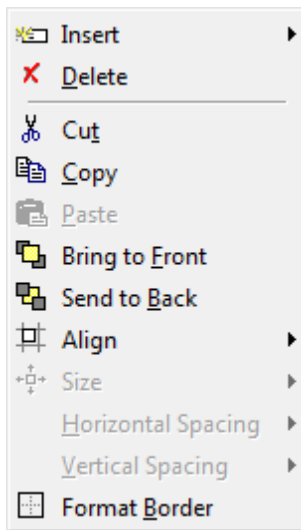
A Report may have a **Report Header** section that is printed at Report's beginning. It is generally used to print report titles, sum tables, charts, and any other information required to appear only once at Report's beginning.

NOTE: A Report Header can extend for multiple pages. To do so, insert a Page Break object in its content.



Report area menu

- **On an object inside a Report:** Only the **Insert**, **Delete**, **Cut**, **Copy**, **Paste**, **Bring to Front**, **Send to Back**, **Align**, and **Format Border** options are enabled



Report object menu

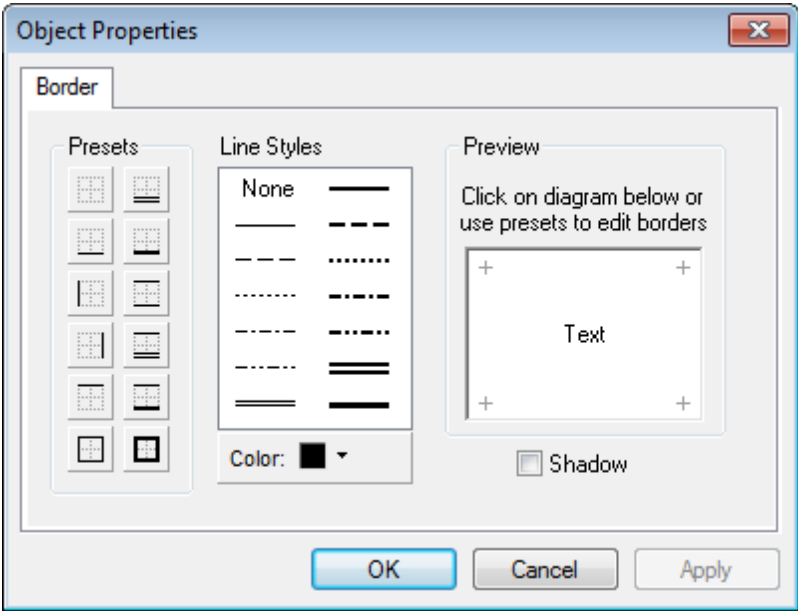
- **On more than one object selected in a Report:** All menu options are enabled

Available options for a Report's contextual menu

OPTION	DESCRIPTION
Insert	Allows inserting a new Report component. The available options are the following: <ul style="list-style-type: none"> • Insert - Group Header/Footer: Adds a new pair of group headers or footers in a Report • Insert - Page Header/Footer: Adds a new pair of page headers or footers • Insert - Report Header/Footer: Adds a new pair of headers or footers in a Report
Delete / Delete Section	Deletes the selected Section, object, or group. This option is not applied to a Report's Detail Section.
Reorder Groups	Reorganizes the selected groups. This option is valid when several Section groups (pairs of headers or footers) are added to a Report. This option is not applied to a Report's Detail Section.
Cut	Cuts the selected object, group, or Section.
Copy	Copies the selected object, group, or Section.
Paste	Pastes an object, group, or Section in the current Report's Section.
Bring to Front	The selected object, group, or Section is sent to the first position in the layer order.
Send to Back	The selected object, group, or Section is sent to the last position in the layer order.
Align	Aligns the selected object, group, or Section. The available options are the following: <ul style="list-style-type: none"> • Lefts: Left alignment • Centers: Center alignment • Rights: Right alignment • Tops: Top alignment • Middles: Middle alignment • Bottoms: Alignment at the same height • To grid: Alignment according to the grid • Center in section: Center alignment in this Section
Size	Specifies the size of the selected object, group, or Section. The available options are the following: <ul style="list-style-type: none"> • Make same width: Same width • Make same height: Same height • Make same size: Same size

OPTION	DESCRIPTION
Horizontal Spacing	Specifies the object's horizontal spacing in a Report. The available options are the following: <ul style="list-style-type: none"> • Make equal: Same spacing among all objects • Increase: Increases object's spacing in one step • Decrease: Decreases object's spacing in one step
Vertical Spacing	Specifies object's vertical spacing. The available options are the following: <ul style="list-style-type: none"> • Make equal: Same spacing among all objects • Increase: Increases object's spacing in one step • Decrease: Decreases object's spacing in one step
Format Border	Specifies the format of object's border in a Report.

When the **Format Border** option is selected, the dialog box on the next figure is shown.



Object border options

The available options are described on the next table.

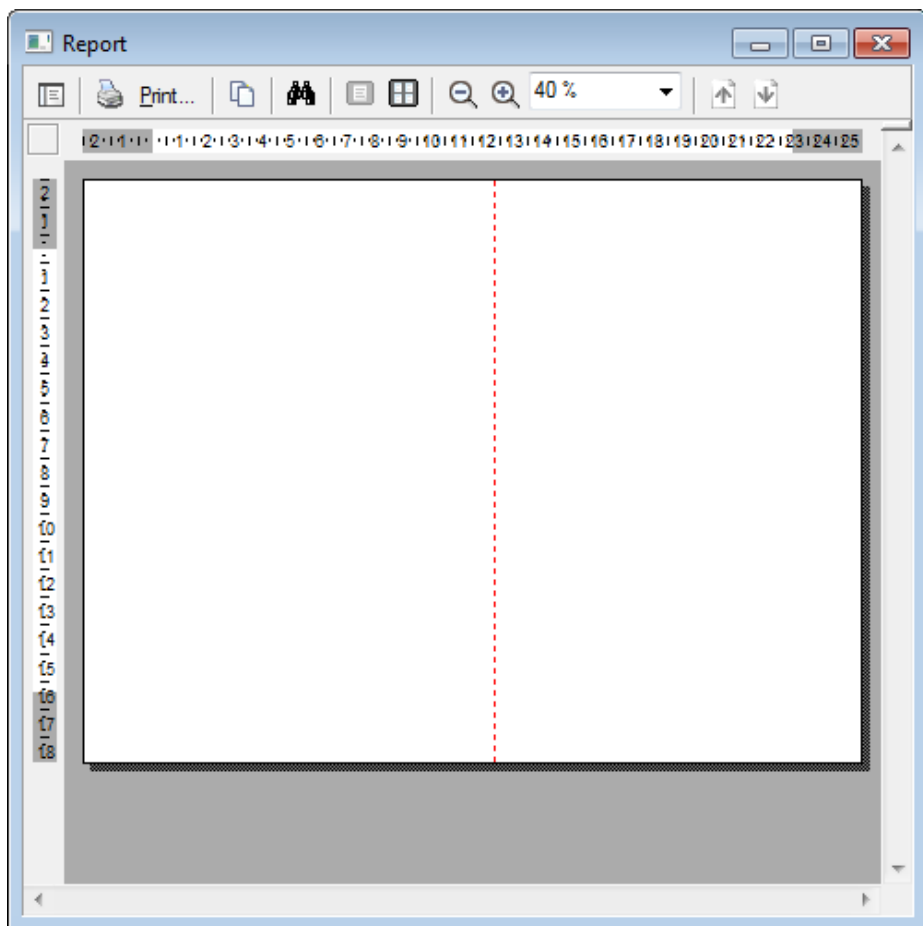
Available options for object's border

OPTION	DESCRIPTION
Presets	Specifies the style of object's external border.
Line Styles	Specifies the style of object's border line.
Preview	Previews object's settings.
Color	Specifies object's border color.
Shadow	Enables or disables object's shadow.

By using the **Reports** toolbar, users have access to all features described in the next sections for a Report.

22.3.1 Preview







By using this option, users can view how a Report is printed. It is also possible to check settings such as margins, figures, etc.







Report's printing preview

The available options are described on the next table.

Printing Preview settings

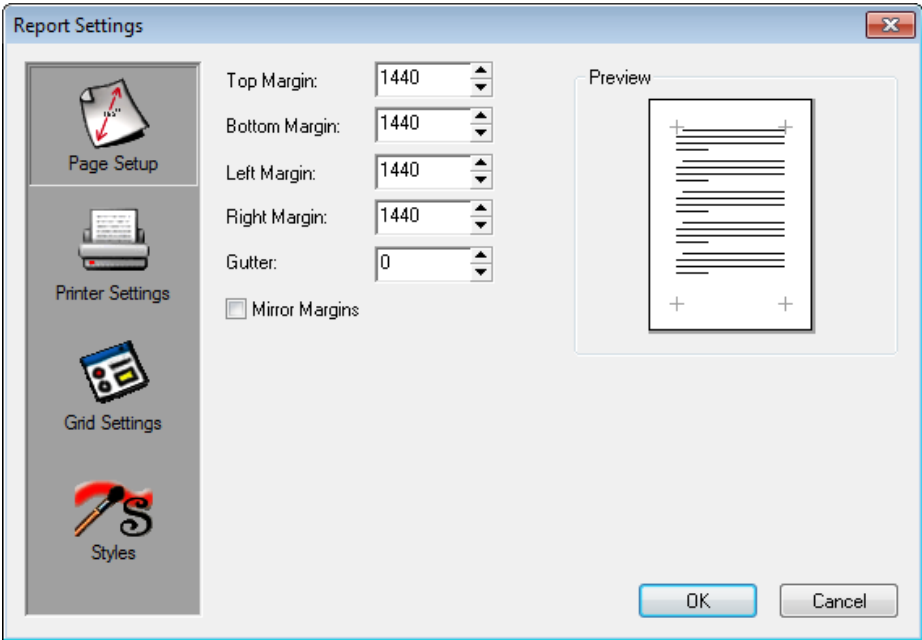
ICON	DESCRIPTION
	Report's table of contents.
	Prints this Report by opening a printer settings dialog box.
	Copies the selected content.
	Searches for a specific text in a Report.
	Views this Report one page at a time.
	Views this Report as multiple pages.

ICON	DESCRIPTION
	Zooms out this page.
	Zooms in this page.
	Zoom percentage for this page.
	Moves to the previous or next page.

22.3.2 Report Settings

By using this option, it is possible to configure Report specifications, such as page, printer, grid and style.

The **Page Setup** option sets up specifications referring to Report's page.



Report's Page Setup

The available options are described on the next table.

Available options for Page Setup

OPTION	DESCRIPTION
Top Margin	Specifies page's top margin.
Bottom Margin	Specifies page's bottom margin.
Left Margin	Specifies page's left margin.
Right Margin	Specifies page's right margin.
Gutter	Specifies page margin.

OPTION	DESCRIPTION
Mirror Margins	Enables or disables page's mirror margin.

The **Printer Settings** option sets up specifications referring to Report's printing.

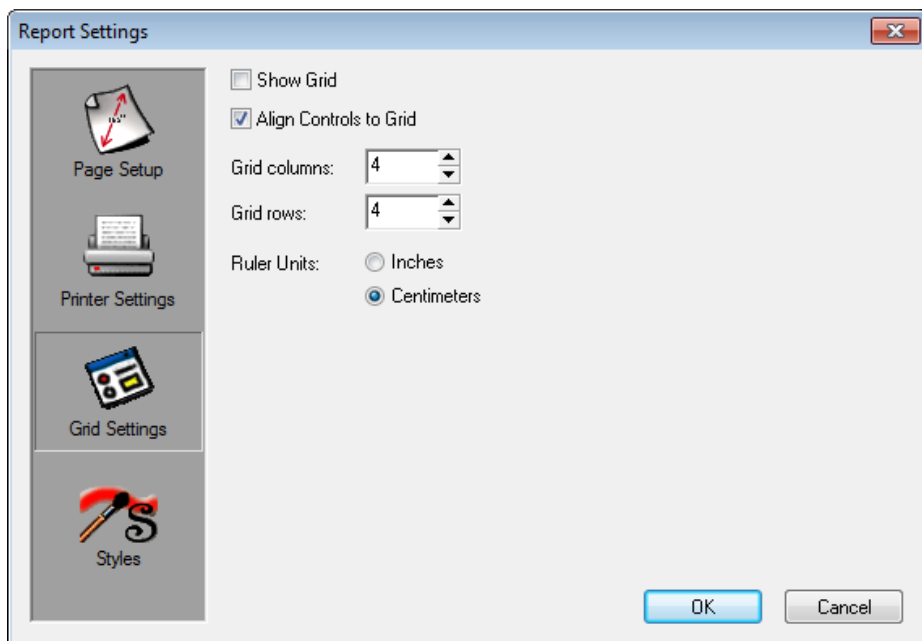
Report's Printer Settings

The available options are described on the next table.

Available options for Printer Settings

OPTION	DESCRIPTION
Paper Size	Specifies paper size.
Width	Specifies paper width.
Height	Specifies paper height.
Orientation	Specifies paper orientation in a printer (Printer Default: Settings according to a default printer, Portrait: Vertical page layout, or Landscape: Horizontal page layout).
Collate	Sorts the printing process.
Duplex	Duplicates the printing process.
PaperBin	Specifies settings and type of paper for the printing process.

The **Grid Settings** option specifies settings referring to Report's grids.



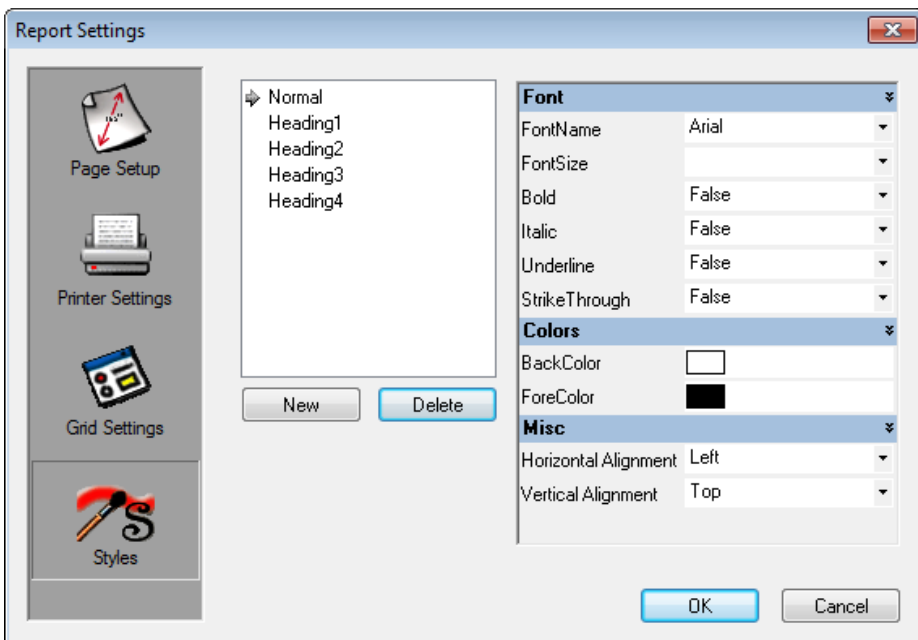
Report's Grid Settings

The available options are described on the next table.

Available options for Grid Settings

OPTION	DESCRIPTION
Show Grid	Enables or disables a grid.
Align Controls to Grid	Enables or disables the alignment of controls in a grid.
Grid Columns	Specifies the number of columns in a grid.
Grid Rows	Specifies the number of rows in a grid.
Ruler Units	Specifies the ruler's unit type (pixel or centimeters).

The **Styles** option specifies settings referring to Report's style.




Report's Styles

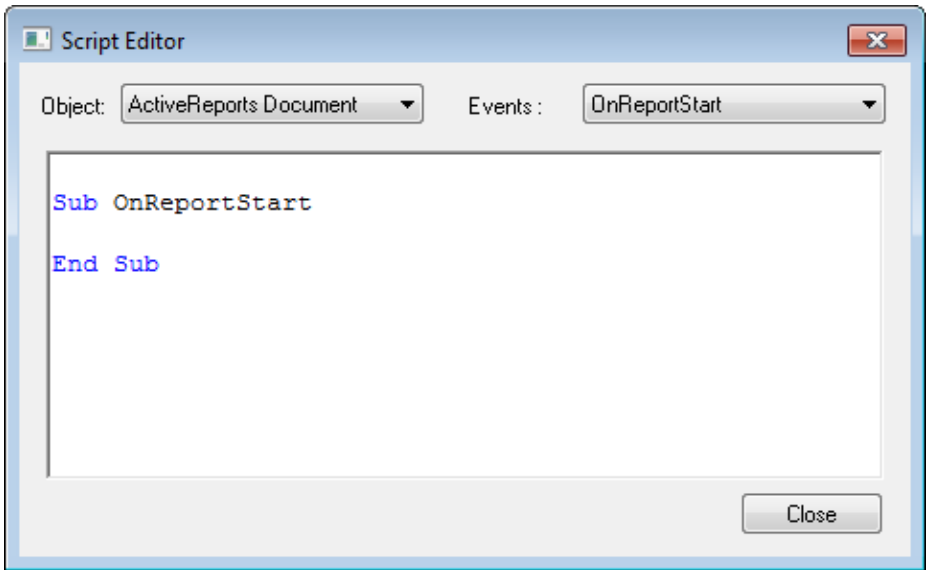
The available options are described on the next table.

Available options for Styles

OPTION	DESCRIPTION
New / Delete / List	Specifies a Report's style. It is possible to insert a new style (by clicking New), to delete a style (by clicking Delete), or to use an existing styles on this list.
Font / Colors / Misc	Specifies settings for a Report's style (fonts, background and foreground colors, orientation, etc.).

22.3.3 Script Editor

The **Script Editor** is used to create scripts in E3 Reports. The language used to create scripts in a Report is **Active Scripting**, which interacts with Visual Basic. When Script Editor window is open, it provides methods and events for Report's objects and components. To use this feature, click **Script Editor** , which is available on the **Reports** toolbar.



Script Editor

In the **Object** field, users must specify an object to create a script and in the **Events** item, a Report's event in which this action occurs.

22.3.4 Load RPX File

Imports a Report configuration from an external file.

22.3.5 Save as RPX File

Exports a Report configuration to an external file.

22.3.6 Objects

This section contains information about objects that can be used in a Report.

22.3.6.1 Line

A **Line** object links two given points. It allows drawing straight lines, by specifying two points during its creation or in polygons.



Line

After inserted on a Report, this object is named as "Line".

22.3.6.2 Rectangle

A **Rectangle** object allows drawing rectangles, by using all of object's width or height. It is created from two vertexes.



Rectangle

After inserted on a Report, this object is named as "Shape".

22.3.6.3 Round Rectangle

A **Round Rectangle** object is a rectangle created from two vertexes, with round corners based on a rounding factor.

When inserted or edited, it displays a small point next to its upper left corner, which allows modifying its rounding factor.

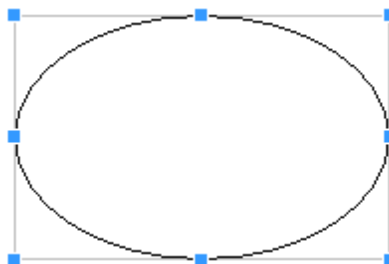


Round Rectangle

After inserted on a Report, this object is named as "Shape".

22.3.6.4 Ellipse

An **Ellipse** object allows users to draw circles and ellipses, by using all of its width or height, and by defining the center of a circle in the center of a rectangle.



Ellipse

After inserted on a Report, this object is named as "Shape".

22.3.6.5 Picture

A **Picture** object allows users to display images stored in files, whether these files are external files or application's resource files.



Picture

After inserted on a Report, this object is named as "Image".

22.3.6.6 Text

A **Text** object enables creating a text. When defining its area on a Report, users can type the desired text directly, which also accepts multiple lines.



Label

After inserted on a Report, this object is named as "Label".

22.3.6.7 SetPoint

A **SetPoint** object is used to insert data from a Database in a Report. This data is indicated using the **DataField** property.



SetPoint

After inserted on a Report, this object is named as "Field".

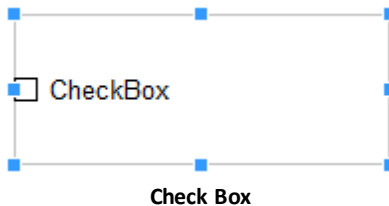
22.3.6.7.1 Usage Example

The following example shows the daily average of a query field in the Report. For that, follow these procedures:

1. Insert a new **GroupHeader/Footer** in the report.
2. Configure the **GroupHeader's DataField** property to `"=Day(E3TimeStamp)"`. This specifies that the average calculation will be performed in a daily basis.
3. Insert a **SetPoint** in the **GroupHeader** with the **DataField** property equal to `"=Day(E3TimeStamp)"`.
4. Insert a **SetPoint** in the **GroupFooter** with the **DataField** property equal to the field name where the average will be calculated.
5. Configure the following **GroupHeader's SetPoint** properties:
 - **SummaryFunc**: 1 - ddSFAvg
 - **SummaryGroup**: GroupHeader1
 - **SummaryRunning**: 1 - ddSRGroup
 - **SummaryType**: 3 - ddSMSSubTotal

22.3.6.8 Check Box

A **Check Box** object inserts data into a Report, which may or may not be bound to a Database. Its value is a **Boolean**.



After inserted on a Report, this object is named as "CheckBox".

22.3.6.9 Bar Code

A **Bar Code** object allows generating a picture that converts a sequence of numbers and characters into a bar code. This bar code is either a numerical or alphanumerical representation, used to facilitate different processes. This representation is decoded using scanners, pens, or optical reading devices.

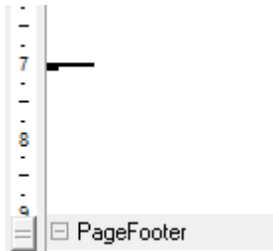


Bar Code

After inserted on a Report, this object is named as "BarCode".

22.3.6.10 Page Break

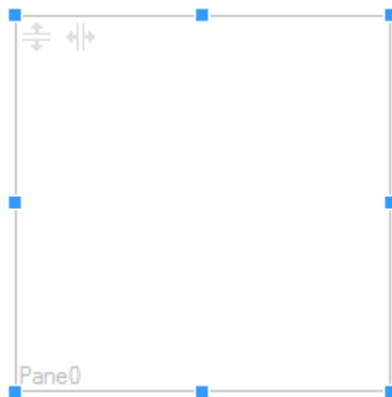
A **Page Break** object is a point where a page finishes and another one starts in a Report. For example, users can force a page break to ensure that a chapter title always begins on a new page. If users work with documents having several pages and manually insert page breaks, it may be necessary to frequently reinsert them as this document is edited. Users can also prevent a page break in a paragraph or in a table row, or else ensure that a page break is not inserted between two paragraphs, such as between a title and the next paragraph.



Page Break

22.3.6.11 Frame

A **Frame** object is composed by rows and columns where texts or charts are inserted. Report Frames are used to organize and display information. Users can also use frames to create page layouts, or to create animated text, charts, or tables as in an HTML page.

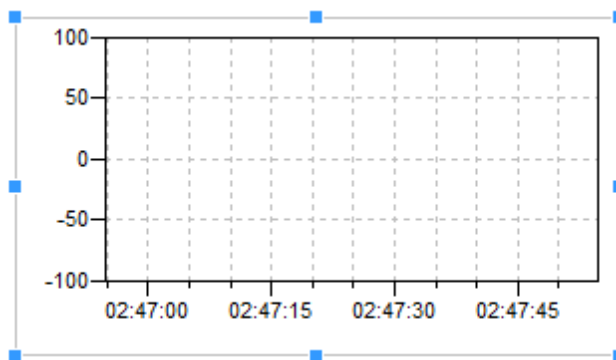


Frame

After inserted on a Report, this object is named as "Frame".

22.3.6.12 E3Chart

An **E3Chart** object is an ActiveX component used to show a chart displaying Tags varying in real time, and also to show historical data stored on a Database.



E3Chart

NOTE: An E3chart cannot be added to a Report's **Detail** Section.

There are some functional differences between an E3Chart in an application and on a Report. In an application, an E3Chart is capable of displaying charts with either real time, historical, or mixed data. On a Report, on the other hand, an E3Chart is not capable of using real time or mixed data, only historical data.

Notice that no Report object can be externally accessed, that is, when users create a Report via application, it is not possible to access its properties, nor its object properties via application scripts. To do so, changes in these objects, including

E3Chart, can only be performed directly in E3 Studio, or in Report's own scripts.
For further information on this object, please check the **E3Chart** chapter.

22.4 Creating a Report in E3

This example shows how to create a Report in E3 to extract data from a Historic object.

22.4.1 Defining Areas

A default Report, created when a new Report is added to a project, contains the following areas:

- **Page Header:** Area shown in all Report pages, as a header
- **Detail Area:** Area repeated as many times as required, it is Report's body
- **Page Footer:** Page footer works in the same way as a **Page Header**

There are two types of Areas:

- **Report Header/Footer:** Areas that are printed only once, regardless of the number of pages of a Report. This area appears as a Report's opening or closing
- **Group Header/Footer:** A group is used to divide a Report in equal sets of values of the same variable. This area repeats whenever a group is displayed. In the example shown here, no construction of this type is used. These areas always encompass a detail area

These two areas can be accessed by right-clicking a Report and then selecting the **Insert** option.

22.4.2 Query Setup

To extract data from a Database, it is necessary to configure a Report's query. There may be many different queries for the same Report, but only one can be active at a specific moment. To do so, follow these procedures:

1. Configure the **DataSource** property (name of a Database where this query is executed. In this case, "DBServer").
2. Specify the **Table** property (a query table, here it is "Data").
3. Configure the **Name** property (keep the original name, "Query1").


22.4.3 Fields Setup

In this example, four temperatures are created and stored on a Historic object, and our Report focuses on these temperatures. In this case, all values read from this Historic object are printed using this Report.

To read data from a Database, the ideal area is the **Detail Area**, as it is automatically repeated as many times as required. This way, five SetPoint objects must be inserted in this area. These SetPoints can be linked to a SetPoint that is configured using its **DataField** property. Here, the following values are used:

- **Field1:** E3Timestamp
- **Field2:** Temperature1 (as configured on the Database)
- **Field3:** Temperature2

22.4.4 Preview

It is possible to view this Report by clicking **Preview** , available in its edition area.

To do so, it is necessary to point out the project's Database server to the MDB file in the folder where this example was saved.

22.5 Usage Examples

The next sections contain some examples of using Report's features.

22.5.1 Setting Up a Bitmap Path When Printing

To use this feature, write the following script on the **OnFormat** event of a **PageHeader** or **ReportHeader** Section:

```
Sub OnFormat
    Report.Sections("ReportHeader").Controls("Image2").Figure = _
        LoadFigure ("C:\mail\test.bmp")
End Sub
```

22.5.2 Setting Up a Bar Code Value Within Detail Section

To use this feature, write the following script on the **OnFormat** event of a **Detail** Section:

```
Sub OnFormat
    Report.Sections("Detail").Controls("BarCode1")._
        Caption = Right(Report.Field ("E3TimeStamp"), 8)
End Sub
```

22.5.3 Capturing a Screen and Generating a Print Preview

To use this feature, type the following script:

```
Sub Rect_Click()  
    ' Calling this method can also be performed  
    ' by using Application.CaptureScreen()  
    Screen.Frame.CaptureScreen("C:\mail\test.bmp")  
    Application.LoadReport("[Report3]").PrintPreview()  
End Sub
```

22.5.4 Generating an Export Menu

To use this feature, write the following script:

```
Sub Rectangle3_Click()  
    Set report = Application.LoadReport("[Report3]")  
    Select Case _  
        Application.SelectMenu("PDF|Excel|HTML|RTF|Text|_  
            TIFF|Text(CSV)")  
        Case 1  
            Report.Export "PDF", "C:\mail\reports\report.pdf"  
            MsgBox "Exported to PDF!"  
        Case 2  
            Report.Export "EXCEL", "C:\mail\reports\report.XLS"  
            MsgBox "Exported to XLS!"  
        Case 3  
            Report.Export "HTML", "C:\mail\reports\report.html"  
            MsgBox "Exported to HTML!"  
        Case 4  
            Report.Export "RTF", "C:\mail\reports\report.rtf"  
            MsgBox "Exported to RTF!"  
        Case 5  
            Report.Export "TEXT", "C:\mail\reports\report.txt"  
            MsgBox "Exported to Text (CSV)!"  
        Case 6  
            Report.Export "TIFF", "C:\mail\reports\report.tiff"  
            MsgBox "Exported to TIFF!"  
        Case 7  
            Set reportFilter = report.GetExportFilter("TEXT")  
            reportFilter.FileName="C:\mail\reports\  
                report2.txt"  
            reportFilter.TextDelimiter = ","  
            report.Export reportFilter  
            MsgBox "Exported to TXT using filter!"  
    End Select  
End Sub
```

22.5.5 How to Create Reports Displaying Page N of M

To create a Report in which each page prints an indication of **Page N of M**, where **N** is the current page and **M** is the total amount of pages, create two Texts and two SetPoints.

These two Texts correspond to **Page** and **of** texts, which must be inserted in the **Caption** property. Those two SetPoints correspond to **N** and **M** values, with the following properties:

Field N

- **Name:** txtPageNumber
- **SummaryGroup:** GroupHeader1
- **SummaryRunning:** 1 - ddSRGroup
- **SummaryType:** 4 - ddSMPageCount

Field M

- **Name:** txtPageCount
- **SummaryGroup:** GroupHeader1
- **SummaryType:** 4 - ddSMPageCount

22.5.6 How to Create Reports Printing Only Value Average at Every Five Minutes

To do so, users must create a new group in a Report. This group has a **Header** and a **Footer** Section. The general layout is:

- **PageHeader:** Contains column titles
- **GroupHeader:** Remains empty, but its **DataField** property is equal to "CLng(E3TimeStamp*288)", because **E3TimeStamp** is the date and time of data in Gregorian format (days since 1/1/1900), where its integer part is the number of days and its fractional part is the hours and minutes. Multiplying by 288 corresponds to a total of five minutes since 1/1/1900. The **CLng** function converts a 32-bit integer and deletes its fractional part, so that intermediate minutes and seconds do not display. This group is then printed each time this number changes, that is, every five minutes. Check the **NewColumn** and **NewPage** properties, which must be set to **0: ddNPNone**
- **Detail:** Contains SetPoints for table fields. Its **Visible** property must be set to False, so that each data acquisition that composes a five-minutes average is calculated, although not printed
- **GroupFooter:** Contains the following fields, representing SetPoint's average:

- **DataField:** Names of table fields (same as in **Detail** Section)
- **SummaryFunc:** 1 - ddSFAvg
- **SummaryRunning:** 1 - ddSRGroup
- **SummaryType:** 1 - ddSGrandTotal

The only exception is for **Date/Time**, which is a standard SetPoint with its **DataField** property set to "CLng(E3TimeStamp*288)/288".

- **ReportFooter:** Blank (or any other value)

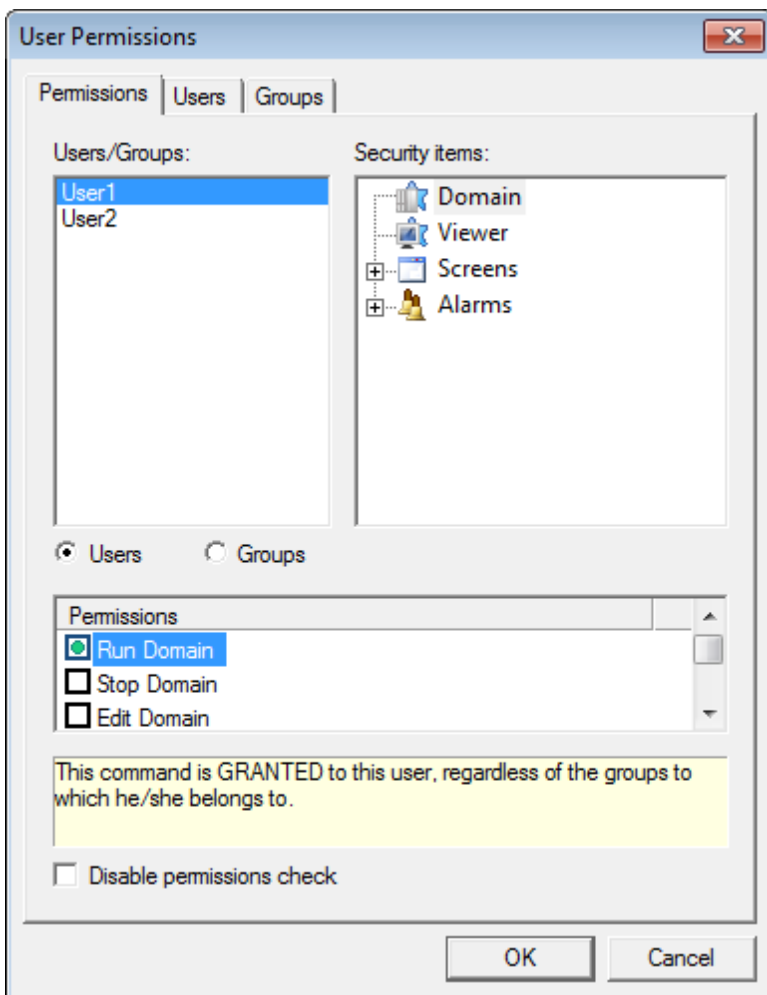
If this query is between 00:00 of one day and another one, its result is composed by 288 printed rows with an average of fields at every five minutes.

By using this option, users can control access to Screens, Alarms, Domains, and Viewers based on a list of users and groups. Depending on these configured options, an application either grants or denies access to registered users.

Access permissions are configured per user or per groups of users. Groups can be created to contain only users, or other groups as well.

To open configurations for users, groups, or permissions, follow this procedure:

1. Go to **File - Users** menu. A dialog box is then displayed to configure application's permissions, users, and groups.



User Permissions window

23.1 Users

On **Users** tab, it is possible to configure information about users who have access or not to an application. To use this feature, click the **File - Users** menu and then select the **Users** tab.

User Permissions

Permissions | **Users** | Groups

User

Name: User1

New... Edit... Remove

Groups

Please choose what group this user belongs to.

Available groups:

- Administration
- Development
- Financial
- IT
- Marketing

Belong to:

Add >

< Remove

OK Cancel

Users tab

The available options on this tab are described on the next table.

Available options for Users tab

OPTION	DESCRIPTION
Name	Indicates the current user
New	Creates a new user
Edit	Edits properties of the selected user
Remove	Removes the selected user
Available groups	Shows all available user groups in an application
Belongs to	Shows all groups to which this user belongs

OPTION	DESCRIPTION
Add	Adds groups from the list Available groups to the list Belongs to
Remove	Removes groups from the list Belongs to

When clicking **New** or **Edit**, the dialog box on the next figure is then displayed.

Add user

Name:

☐ Windows Authentication

☒ E3 Authentication

User information

Password:

Confirm password:

Full name:

☐ This is an administrator user

Security Policies

☒ User cannot change their password

☒ Password expires after days

☒ Password must have at least characters

☒ Password must have letters and numbers

☒ Password must have at least numbers

☒ Password must have at least letters

☒ Password must have uppercase and lowercase letters

☐ This account is disabled

☐ This account is blocked

☐ User must change their password in the next login

☒ Password checking is not case sensitive (not recommended)

Adding users to an application

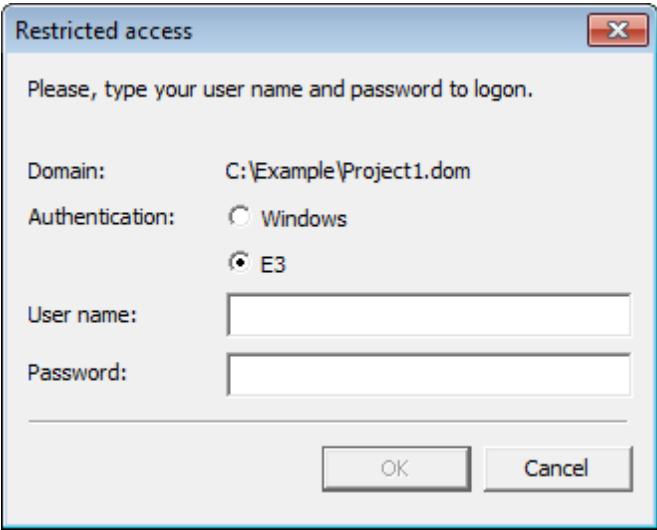
The available options for this window are described on the next table.

Available options for Add user window

OPTION	DESCRIPTION
Name	Specifies user's name.
Windows Authentication	This option allows adding an existing user of a Windows network domain. This user name must be formatted as DOMAIN \USER . When selecting this option, all other options on this window are disabled, except This is an administrator user and This account is disabled .
E3 Authentication	This option creates a user in the current E3 Domain.
Password	Specifies user's password.
Retype password	Confirms again the previously typed password.
Full name	Specifies user's full name.
This is an administrator user	Enables this user as an administrator.
User cannot change their password	Users cannot change their passwords, because only an administrator can perform this task.
Password expires after ... days	Establishes a password's expiring date. A few days before this deadline, an application displays a message reminding users of the need to renew their password. When they choose to do so, a dialog box opens to perform this task. If this password expires before users actually change it, they cannot log in this application, and the This account is blocked option is automatically enabled. This condition remains until an administrator manually unblocks it.
Password must have at least ... characters	Establishes a minimum amount of characters for user's password.
Password must have letters and numbers	Establishes whether this password must have letters and numbers.
Password must have at least ... numbers	Establishes a minimum amount of numbers for user's password.
Password must have at least ... letters	Establishes a minimum amount of letters for user's password.
Password must have uppercase and lowercase letters	Establishes that this password must have uppercase and lowercase letters.
This account is disabled	Indicates that this account is disabled.
This account is blocked	Indicates that user's account is blocked. This option is automatically enabled if this password expires or when users type it incorrectly a certain number of times.
User must change their password in the next login	Establishes that users must change their passwords the next time they log in.

OPTION	DESCRIPTION
Password checking is not case sensitive	Enables password validation, regardless of letters being uppercase or lowercase. This option is not recommended.

When performing a user's login (by using Viewer's **Login** method, or by using the **File - Login** menu), the dialog box on the next figure is then opened.

A screenshot of a Windows-style dialog box titled "Restricted access" with a close button (X) in the top right corner. The dialog contains the text "Please, type your user name and password to login." Below this, there are two rows of labels and controls. The first row is "Domain:" followed by a text field containing "C:\Example\Project1.dom". The second row is "Authentication:" followed by two radio buttons. The first radio button is labeled "Windows" and is unselected. The second radio button is labeled "E3" and is selected. Below the radio buttons are two text input fields, one labeled "User name:" and one labeled "Password:". At the bottom of the dialog are two buttons: "OK" and "Cancel".

Login window

If the **Windows** authentication mode is selected, the **User name** and **Password** fields are disabled, and filled in with the name and password of the currently user logged in the network domain. To select another user belonging to a network domain, click **Other user**. If the **E3** authentication mode is selected, fill in information about a user and a password for an E3 Domain's user in the **User name** and **Password** fields, respectively.

When the **This user is an administrator** option is enabled for a given user, this user can, at run time, change all configurations displayed on the **Users** tab.

These privileges can be configured via scripts using Viewer's **UserAdministration** method, which enables a user's dialog box at run time.

NOTE: Only an administrator has access to Viewer's **UserAdministration** method.

When clicking **Remove**, an application shows a message box asking to confirm whether users really want to remove that user.

Users can also belong to a group, thus sharing the same configurations with other users of that group. To do so, the list **Available groups** contains all groups available

in an application that may contain the selected user, and the list **Belongs to**, contains a list of groups to which the selected user already belongs. To add a user to a group, follow these procedures:

1. Select a user to insert into a specific group.
2. On the list **Available groups**, select a group to which this user is going to belong.
3. Click **Add** to add that group, which then appears on the list **Belongs to**.
4. To remove a group, select it from the list **Belongs to** and then click **Remove**.

23.2 Groups

The **Groups** tab allows configuring information about groups. Each group defines a certain number of features, which are shared by all its members. A group can also belong to other groups. It is not allowed, however, belonging to a group that already belongs to it, that is, creating a circular reference.

To use this feature, click the **File - Users** menu and then select the **Groups** tab.

User Permissions

Permissions | **Users** | Groups

Group

Name:

Groups

Please choose what groups this group belongs to.

Available groups:

- Development
- Financial
- IT
- Marketing

Belong to:

Groups tab

The available options are described on the next table.

Available options for Groups tab

OPTION	DESCRIPTION
Name	Indicates the current group.
New	Creates a new group.
Edit	Edits properties of the selected group.
Remove	Removes the selected group.
Available groups	Shows all available groups in an application.
Belongs to	Shows all groups to which the selected group belongs.

OPTION	DESCRIPTION
Add	Adds groups from the list Available groups to the list Belongs to .
Remove	Removes groups from the list Belongs to .

When clicking **New** or **Edit**, the dialog box on the next figure is then displayed.

Add group window

The available options are described on the next table.

Available options for Add Group window

OPTION	DESCRIPTION
Group name	Establishes a group's name.
User cannot change its password	Users cannot change their passwords, only an administrator can perform this task.
Password expires after ... days	Establishes a password's expiring date.
Password must have at least ... characters	Establishes a minimum number of characters for this password.

OPTION	DESCRIPTION
Password must have letters and numbers	Establishes whether this password must have letters and numbers.
Password must have at least ... numbers	Establishes a minimum number of numbers for this password.
Password must have at least ... letters	Establishes a minimum number of letters for this password.
Password must have uppercase and lowercase letters	Establishes that this password must have uppercase and lowercase letters.
Password checking is not case sensitive	Enables a password validation, regardless of letters being uppercase or lowercase. This option is not recommended.

When clicking **Remove**, an application shows a dialog box asking to confirm whether users really want to remove that group.

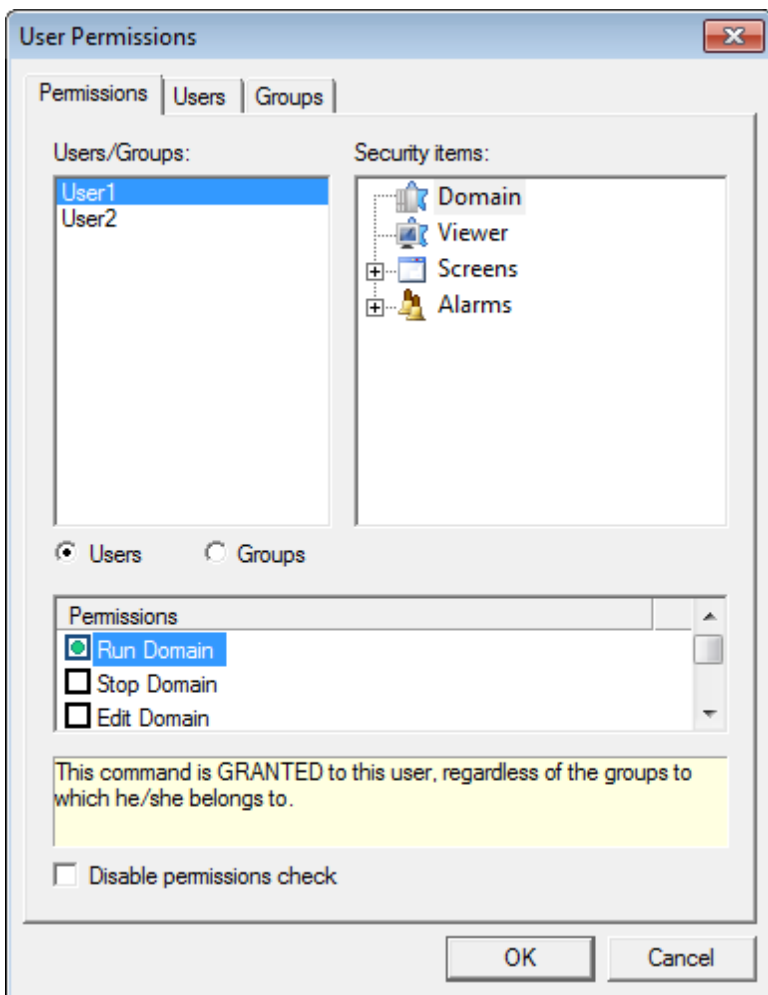
Groups can also belong to other groups, and they can share the same configurations. To do so, the list **Available groups** displays all groups available in an application that may contain the selected group, and the list **Belongs to** display the list of groups to which the selected group belongs. To add a group to another group, follow these procedures:

1. Select a group to insert into another group.
2. On the list **Available groups**, select a group to which this group is going to belong.
3. Click **Add** to add this group, which then appears on the list **Belongs to**.
4. To remove a group, select it on the list **Belongs to** and then click **Remove**.

NOTES: Users must notice the hierarchy between users and groups. If a certain option is disabled for a user, but enabled for a group, this user permission precedes the group, which has this item disabled. A group option is only respected when the same user option is set as neutral.

23.3 Permissions

The **Permissions** tab allows configuring user and group permissions for Screens, Alarms, Domains, and Viewers. A permission check is an information that a group member has about a command that acts on a specific object.



Permissions tab

The available options on this tab are described on the next table.

Available options for Permissions tab

OPTION	DESCRIPTION
Users/Groups	This option lists users or user groups configured in an application.

OPTION	DESCRIPTION
Security Items	<p>The available security items are:</p> <ul style="list-style-type: none"> • Screens: Allows users to enable or disable access to Screens. In an application, all users or groups have access to the main Screen • Alarms: Enables or disables alarm acknowledgment for a user or a group. In a project, it is possible to display alarm information to several subscribers of that information by using a Screen object, such as an E3Alarm • Domains: Allows users to configure permissions to execute, stop or edit a Domain, and remotely access a Domain, among other permissions • Viewer: Allows users to use a Viewer in Viewer Full or Viewer Only mode, according to its settings
Users	It is a filter for configuration options. By enabling this option, it is possible to view only registered users in an application.
Groups	It is a filter for configuration options. By enabling this option, it is possible to view only registered groups in an application.
Permissions	Shows user or group permissions relative to security items (Screens, Alarms, Domains, and Viewers).
Disable permissions check	Disables any permission check. Please check the following note about the behavior of this option.

NOTE: The **Disable permissions check** option must be used carefully, because it implies the following behaviors:

- A login always works, even when a password is wrong or when using a non-existent user name
- Actions are always allowed, even for anonymous users

For each security item, there is a series of permissions that can be configured for each user or group. The available options are described on the next table.

Available options for Screens

OPTION	DESCRIPTION
Open Screen	Enables opening Screens.

Available options for Alarms

OPTION	DESCRIPTION
Acknowledge alarm	Enables an alarm acknowledgment.

Available options for Domains



OPTION	DESCRIPTION
Run Domain	Enables running a Domain.
Stop Domain	Enables stopping a Domain.
Edit Domain	Enables editing a Domain.
Run as service	Enables running a Domain as a service.
Configure user/groups	Enables configuring users and user groups.
Remote access to Domain	Enables remote access to a Domain.
Remote write access to Domain	Enables remote writing access to a Domain.




Available options for Viewers

OPTION	DESCRIPTION
Write access to server	Enables writing access to a server.

Each item on a permissions list can be configured with one of the statuses on the next table.

Options for a permissions list

ICON	STATUS	DESCRIPTION
	Allowed (solid green circle)	The selected command on this permissions list is granted to the selected user or group, regardless of all groups to which they belong.
	Not allowed (solid red circle)	The selected command on this permissions list is not granted to the selected user or group, regardless of all groups to which they belong.

ICON	STATUS	DESCRIPTION
	Allowed by this group (hollow green circle)	The selected command on this permissions list is granted to the selected user or group, if it is granted on groups to which the selected user or group belongs.
	Not allowed by this group (hollow red circle)	The selected command on this permissions list is not granted to the selected user or group, if it is not granted to at least one of all groups to which the selected user or group belongs.
	Not informed (hollow square)	The selected user or group uses all configurations from all groups to which they belong, and there is nothing informed on those groups. Therefore, the selected command is granted.

For Screens, this configuration of permissions can be performed by Screen specifically. For Alarms, this configuration can be performed by Area.

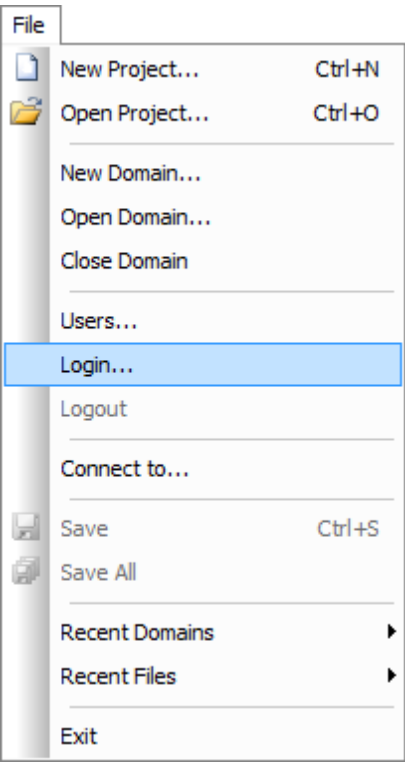
NOTE: In an application, all users have access to its initial Screen. In case users want that application to always start displaying a user login dialog box, create a user with no specific permission for its initial Screen. Thus, every time this application starts, it asks for a user login, and after that it displays its initial Screen.

As for anonymous user permissions, users must notice the following situations:

- If there are no users at all, a permission check is not enabled, or there is no user with restrictions for a certain operation, then a user identification is not required (users can log in as anonymous)
- If there are users in an application, a permission check is enabled, and at least one user cannot execute a certain operation, then this operation requires a user identification (users cannot log in as anonymous)

NOTE: Name and description of these restriction options can be viewed using the **Legend** option.

In case there is any restriction to run, stop, edit a Domain, or to configure users or groups, users must be logged in E3. To do so, use the **Login** or **Logout** options, available on the **File** menu.



User Login or Logout

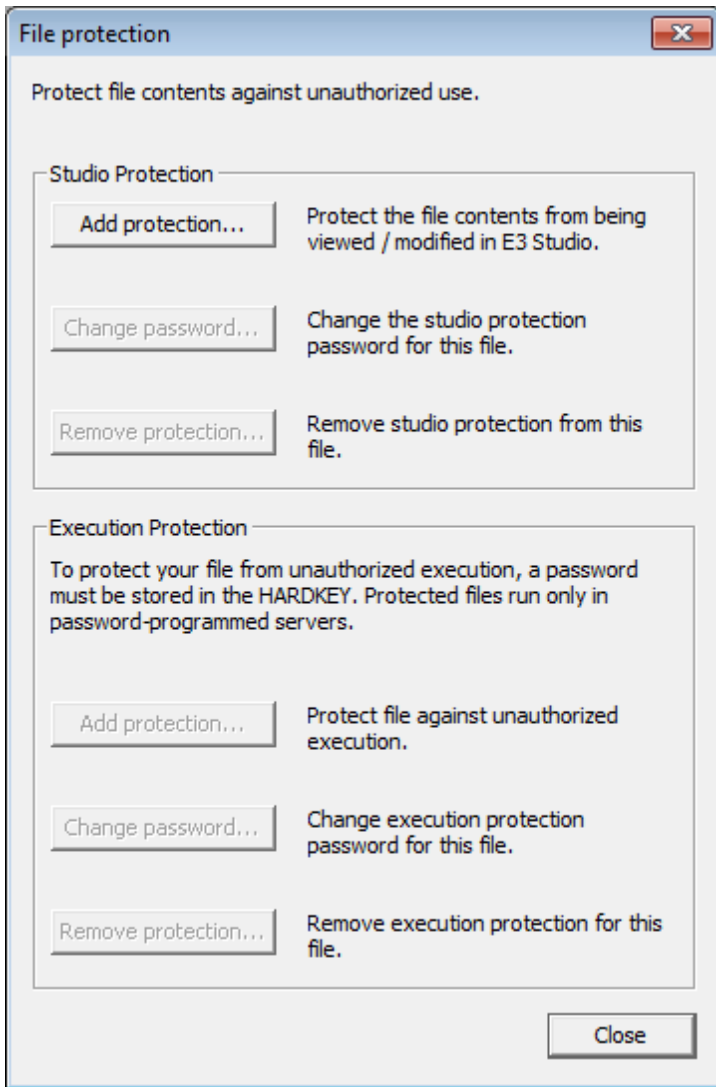
The **Login** option opens a dialog box for logging in E3 Studio. Users remain logged in until another login or logout is performed.

The **Logout** option executes a log out from E3 Studio. In case no user is logged in, this option is then disabled.

23.4 File Protection

Protects a .prj or .lib file content against unauthorized edition, viewing, or execution. To use this resource, follow these procedures:

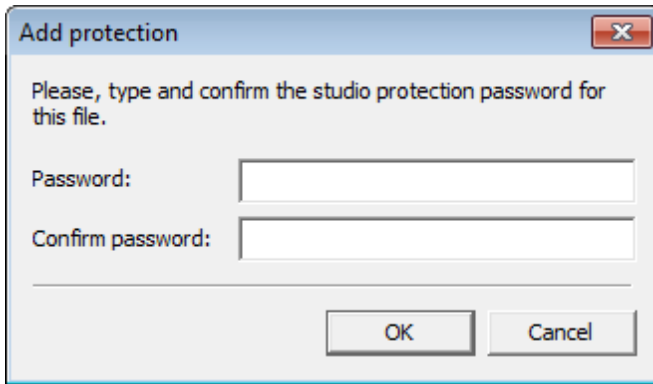
1. Right-click the project's or library's name in Explorer and then select the **Protection** option. In **Domain** mode, right-click the project's or library's name, in the **Settings - Files** item, and then select the **Protection** option.
2. The following window is then displayed.



File protection window

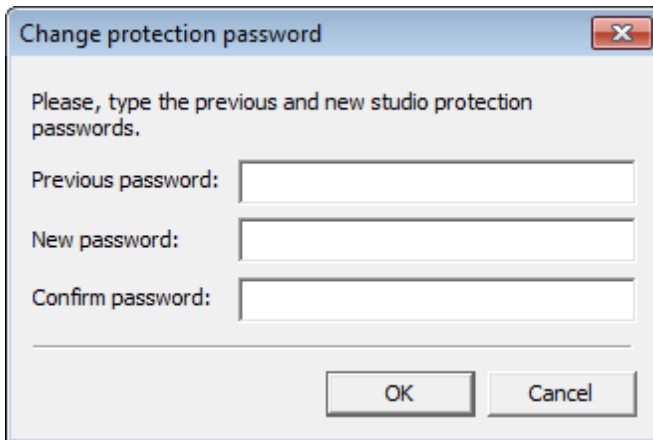
This window has two types of protection: **Studio Protection** and **Execution Protection**.

- **Studio Protection:** Protects a file against unauthorized changes or views. This resource is used to prevent a given library or project from being accidentally changed, or that developer's exclusive procedures from being copied
 - The **Add protection** option allows users to configure a protection password for an application.



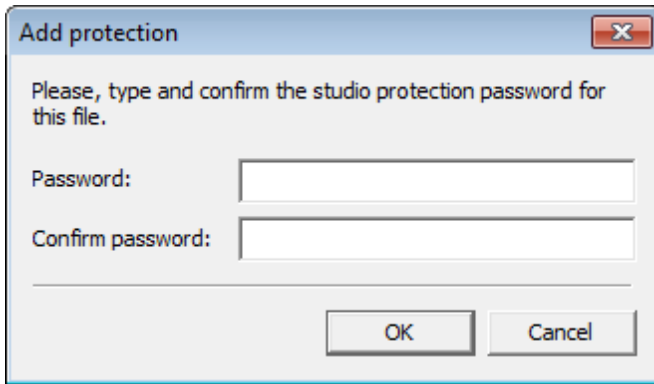
Add protection

- The **Change password** option changes E3 Studio's protection password for that file.



Change password

- The **Remove protection** option removes an edition protection from a file. To do so, click it, type a password, and click **OK**. The application then opens a dialog box that informs whether this action was executed successfully.
- **Execution Protection:** This option is used to protect a file against unauthorized execution. To do so, users must ask for a protection device-recorded password, which is performed by Elipse Software. This protects the developer against project's unauthorized copies, for example. To do so, when asking for an E3 Server's license, users must provide that execution password. This process is performed after purchasing a server
 - The **Add protection** option allows users to configure a protection password for an application.





Add protection

- The **Change password** option changes an execution's protection password for a file.



Change password

- The **Remove protection** option removes an execution protection from a file. To do so, click it, type a password, and click **OK**. The application then opens a message box that informs whether this action was executed successfully.

When a .lib or a .prj file is opened in E3 Studio, it displays a gray icon , with a lock indicating that this file is protected and its content is not available. To access this file's content, right-click this project or library and select the **Open with a password** option. After typing a password, and the application granting access to its content, this icon becomes colorful , indicating file accessibility.

The content of protected .lib and .prj files is encrypted. Whenever a project is protected, the **DocString** and **Domain** properties are blocked.

IMPORTANT: All implemented protections cannot be bypassed in case of a password loss. So, when protecting a file, store this password in a safe place. This guarantees that files are available whenever they are needed.

E3 Viewer is an E3's viewing environment. With E3 Viewer, users can watch the execution of applications created in E3 Studio.

E3 WebViewer is an ActiveX component that causes a browser to behave as an E3 Viewer, which enables viewing and controlling E3 applications via Internet. Thus, it is possible to view and interact with a plant floor process by using a regular web browser. This browser can be installed in any computer on a network with access to E3 Server.

After installed, an E3 WebViewer works exactly as an E3 Viewer, downloading an application (Screens, bitmaps, etc.) to the local machine. All E3 Viewer functionality (E3Chart, E3Alarm, etc.) is supported by an E3 WebViewer.



E3 WebViewer running (viewing an application)

NOTE: E3 Viewer and E3 WebViewer both accept the same zoom options described on topic **Zoom** of chapter **Screen and Screen Objects**. In addition, drawing quality of Screens can be modified, at run time, by using both E3 Viewer's and E3 WebViewer's contextual menu, and selecting one of the options of the **Quality (all screens)** menu. For more information, please check Viewer's **RenderQuality** property, on **Scripts Reference Manual**.

24.1 Viewer Only (Read-Only Mode)

A **Viewer Only** mode (**Read-Only** or restricted access mode) is a way of controlling access of a Viewer has to a server (Domain), as opposed to a **Viewer Full** mode, which has no access restrictions.

By using user permissions settings (on chapter **Security**), and according to the type of Viewer license in use (on chapter **Domains**), a server then determines whether a Viewer is in **Full** (normal) or **Only** (restricted) mode. When an **Only** mode is on, several restrictions apply to actions that can be written to a server. In this case, the following items are blocked (by script error or by generating an error message):

- General writing on server's object properties via Viewer Links
- General writing on server's object properties via Viewer scripts
- Viewer's **SetValue** and **ToggleValue** methods (including **Load** and **Toggle Value Picks**)
- Calling server's object methods via Viewer scripts (please check for exceptions further on this topic)
- User administration via Viewer (by using Viewer's **UserAdministration** method)
- Acknowledging alarms via E3Alarm
- Using Viewer's **LoadFormulaDlg**, **LoadFormulaValues**, and **LoadFormulaValuesQuiet** methods

The following items remain allowed when this mode is on:

- Reading server's object properties, via Links or scripts
- Calling methods considered non-restricted for server objects via Viewer scripts. These are: **Item** (all objects); **Refresh** (OPC Group); **FindUnit**, **FindValue**, **GetValueData**, and **GetUnitData** (Formula); **GetAlarm** (Alarm Source); **GetE3QueryFields**, **GetADOREcordSet**, and **GetAsyncADOREcordSet** (Query); and **GetObject** (ServerApplication)
- Changes in the Advise status of server Tags
- Changing user's own password (Viewer's **ChangePassword** method)

24.1.1 Changes in Viewer Mode

For users to have access to E3 with **Read-Only** mode on, at least one of these two conditions must be true:

- The license in use must be of type **Viewer Only**
- A user logged on with no permission to access a **Writing access to the server** item

It is worth noticing that in case there is no user logged on a Viewer (anonymous user), access restrictions apply as long as one or more users have this restriction.

Thus, every time a user changes, Viewer's access mode can be changed (and consequently the **IsReadOnly** property), according to the result of a combination between what is permitted by the license in use and the permission of the logged in user.

Changing access mode can also happen in case there is a Viewer reconnection, since it can trigger either a license change (from **Viewer Full** to **Viewer Only**, or vice versa) or a change in permissions of the logged in user.

In case there is any user with a blocked writing access to a server when Viewer opens, they enter this application automatically with **Read-Only** mode on, regardless of the license in use, since an anonymous user always assume the maximum configured restriction.

24.2 Executing E3 Viewer

There are three ways to execute E3 Viewer: via local server, via intranet server, or via Internet server. The next topics have more details about each one of them.

24.2.1 Via E3

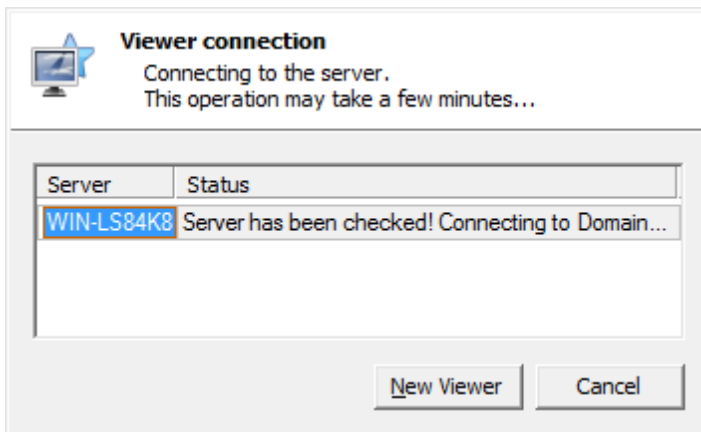
Users can execute E3 Viewer via **Default** toolbar:



Default toolbar

- **!!! Saves and runs the Domain:** Saves all project configurations, runs a Domain, and then executes E3 Viewer
- **▶ Runs/Stops Domain:** Executes or stops Domain execution
- **□ Runs/Stops E3 Viewer:** Executes E3 Viewer, or stops its execution in case it is already open

When E3 Viewer is executed, the window on the next figure is displayed, indicating a connection status.



E3 Viewer connection status

Whenever losing a server connection, E3 then tries to reconnect automatically, according to server's configurations. To determine which server performs a connection in case of an E3 Viewer failure, it is necessary to configure the **Servers** option, configured via E3 Admin, as explained in chapter **Domains**.

24.2.2 Via Command Line

E3 Viewer can also be accessed via command line:

```
Viewer [server_name] [options]
```

The *server_name* parameter stands for the name of a machine where E3 Server is executing. If not informed, a dialog box is displayed asking about application's server path, as when executing E3 Viewer from the **Start** menu (as shown in the next topic).

Configuration options for this command prompt are:

- **-screen or /screen:** Allows users to inform a valid initial Screen, different from the one configured in a Domain

```
Viewer [server_name] -screen <screen_name>
```

- **-noping or /noping:** Discards the need to perform a **ping** command to a server before attempting to connect (a direct connection attempt)

```
Viewer [server_name] -noping
```

- **-readonly or /readonly:** Allows users to specify whether Viewer tries to connect in **Read-Only** mode. When it is performed, Viewer always uses a **Viewer Only** license

```
Viewer [server_name] -readonly
```

- **-cachepath or /cachepath:** Allows users to specify a different directory to save Viewer's cache. If it is omitted, this value is Windows' default temporary directory (the *TEMP* environment variable)

```
Viewer [server_name] -cachepath <directory>
```

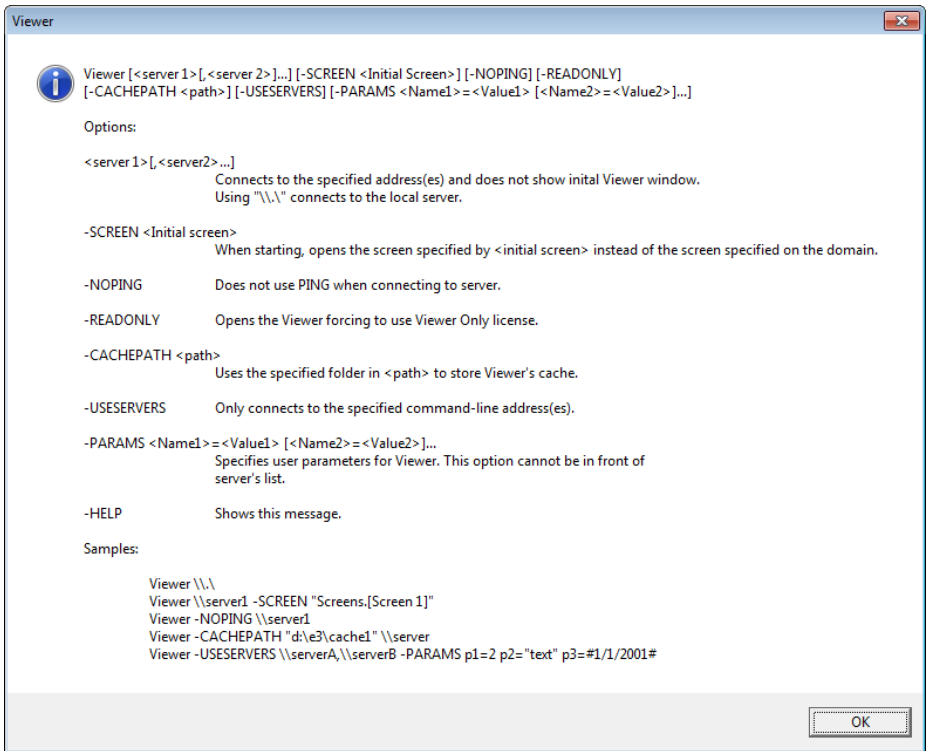
- **-useservers or /useservers:** This option enables Viewer to try to connect only to servers specified on the command prompt. If this option is not present (its default behavior), Viewer can try to discover alternative servers in case it cannot connect to servers passed as parameters on the command prompt. This option works only on a local network, therefore it must be informed in case a server that Viewer is trying to access is outside the local network

```
Viewer [server_name] -useservers
```

- **-params:** Allows users to specify Viewer's initialization parameters. This option cannot be specified immediately before a list of servers. Values passed on this option can be retrieved via script using Viewer's **Params** property. For more information about this property, please check chapter **Viewer on Scripts Reference Manual**

```
Viewer -params <Name1>=<Value1> [<Name2>=<Value2>] ...
```

- **-help:** Displays a dialog box with usage examples of Viewer's command prompt options, as in the next figure

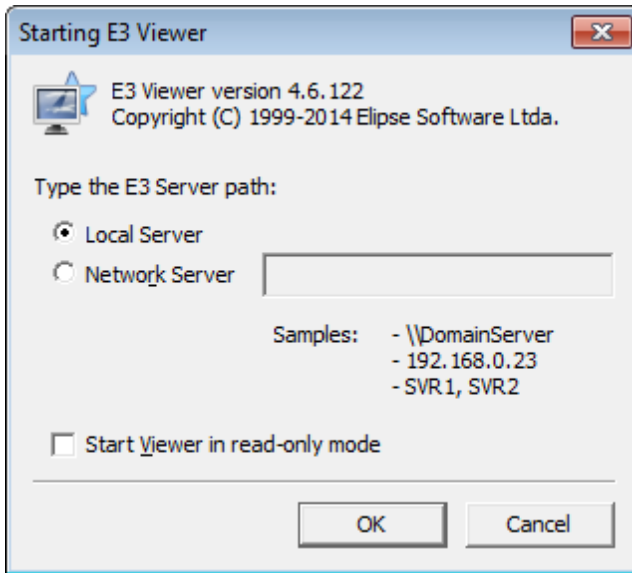


Viewer's help dialog box

24.2.3 Via Start Menu

To execute a client application, users can access E3 Viewer, available on the **Start - Programs - Elipse E3 - Viewer** menu.

E3 then shows the following dialog box, so that users can inform an application's server path.



E3 Viewer

If E3 Server is in the same machine as E3 Viewer, select the **Local Server** option. If they are in different machines, select the **Network Server** option and inform either a name or an IP address of the machine running E3 Server. If E3 Server is available in a port other than the default (6515), inform this port number in the **Network Server** field right after IP number, separated by a colon. To connect in **Read-Only** mode, select the **Start Viewer in read-only mode** option.

24.3 Viewer Logs

E3 generates logs in ETL (*Event Trace Log*) format. These log files are managed by an Elipse tool called **Elipse Event Log Viewer**, available with E3 installation. With this tool, users can view files and manage the space they occupy on disk, among other tasks. For more information on **Elipse Event Log Viewer**, please check **Elipse Event Log Viewer User's Manual**, available on **Start - Programs - Elipse Software - Elipse Event Log** menu. **Elipse Event Log Viewer** can be opened in three different ways:

- Using **Start - Programs - Elipse Software - Elipse Event Log - Log Viewer** menu
- Using E3 Studio's **Tools - Log Viewer** menu
- Using E3 Admin's **Shortcuts - Log Viewer** contextual menu on Windows Notification Area

24.4 Executing E3 WebViewer

During E3 WebViewer installation, e3web.asp, e3web2.asp, docwrite.asp, docwrite2.asp, and e3downloader.cab files become available for user

configuration. These files are located on the same directory where E3 was installed, on **Web** folder.

- **e3web.asp and docwrite.asp**: Responsible for loading and starting E3Downloader ActiveX
- **e3downloader.cab**: ActiveX that is sent to a client machine to install e3webviewer-x86-enu.exe
- **e3web2.asp and docwrite2.asp**: Responsible for loading and starting WebViewer's ActiveX that shows an application executed on client machine's Internet Explorer

docwrite2.asp page is initially configured as if E3 Server and web server are executing on the same computer. However, users can change this page's source code to meet their needs. To do so, change the following line on source code:

```
var Domain = getDomain();
```

To:

```
var Domain = "IIS server's external IP";
```

In case users want to allow a user to inform a valid initial Screen, different from the one configured in a Domain, change the next line by typing in *screen_name* a valid application's Screen name:

```
<param name='Screen' value='screen_name'>
```

In case users want to inform whether a **ping** command to a server must occur before trying a connection, change the next line. Its value can be either "True" or "False".

```
<param name='Ping' value='TRUE'>
```

If this line is omitted, a **ping** command is executed.

In case users want to navigate to a page other than default after loading E3 WebViewer, they must change the *value* attribute of the *URLToLoad* parameter to a new address:

```
<param name='URLToLoad' value='url'>
```

If this line is omitted, e3web2.asp page is then loaded.

In case users want to specify a different directory to save Viewer's cache, change the next line. If it is omitted, this value is Windows' default temporary directory (the *TEMP* environment variable).

```
<param name='cachepath' value='cache_directory'>
```

In case users want WebViewer to search for other servers on a network if it cannot

connect to a server specified on the *Domain* parameter, they must change the next line. If this parameter is not informed, WebViewer tries to connect only to a server specified by the *Domain* parameter, which is its standard behavior (a True value). Changing this value to False only works for servers and WebViewers on the same network.

```
<param name='useservers' value='FALSE'>
```

E3 WebViewer's configuration to open in **Read-Only** mode is performed via **StartReadOnly** property (either True or False). If there is no such item, then it assumes a False value (this behavior is compatible with previous versions). Example:

```
var content = "<object classid='clsid:7EB4D157-FACC-45BB-9536-C14B9DCE3CA7'";
content += " width='100%' height='100%'>";
content += "<PARAM NAME='Domain' VALUE='192.0.0.21'>";
content += "<PARAM NAME='Screen' VALUE=''>";
content += "<PARAM NAME='CachePath' VALUE=''>";
content += "<PARAM NAME='Ping' VALUE='0'>";
content += "<PARAM NAME='StartReadOnly' VALUE='FALSE'>";
content += "</object>";
document.write(content);
```

In both cases, this configuration is only effective when opening E3 WebViewer. If this property is changed at run time, E3 WebViewer's connection or reconnection are not affected at all.

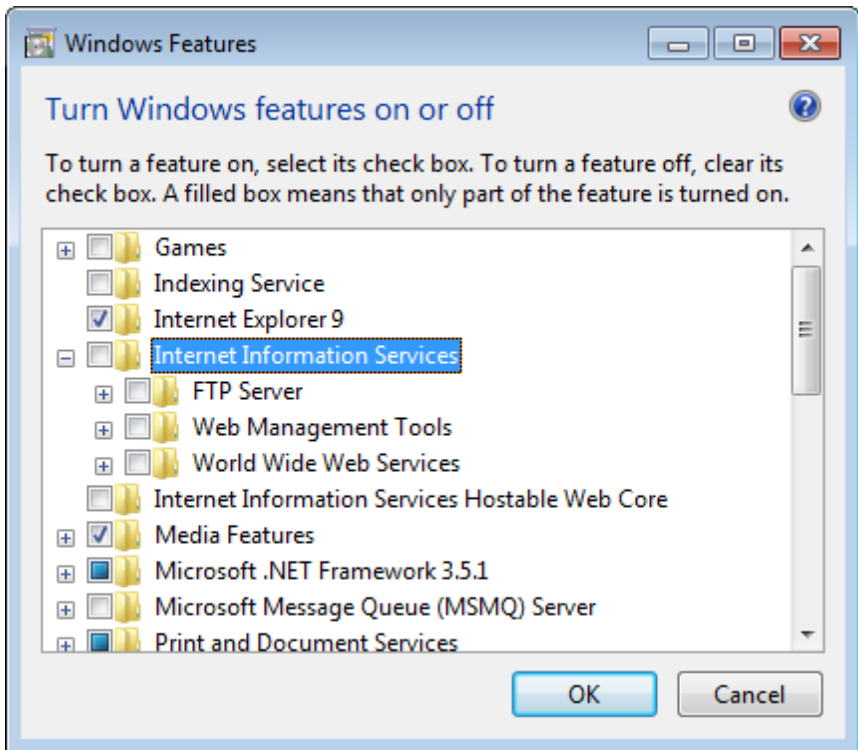
Both servers and E3 WebViewer can execute on the same machine or on different machines. The next topics show how these situations apply.

24.4.1 Internet Information Services

To view on the Internet, as well as on an Intranet or a local machine, it is necessary to install and configure IIS (*Internet Information Services*), or another Internet server.

IIS is supplied along with Windows. To install and configure it, follow these procedures:

1. Open the **Start - Control Panel** menu on **Windows Server 2003 SP2**, **Windows XP SP3**, **Windows Vista SP2**, and **Windows 7 SP1**, or open the **Apps - Windows System - Control Panel** item on Start screen on **Windows 8** and **Windows 8.1**. On **Windows 10**, right-click the **Start** menu and select the **Control Panel** item.
2. Click **Add or remove programs** on **Windows Server 2003 SP2** and **Windows XP SP3**, or click **Programs and Features** on **Windows Vista SP2**, **Windows 7 SP1**, **Windows 8**, **Windows 8.1**, and **Windows 10**.
3. Click **Add or remove Windows component** on **Windows Server 2003 SP2** and **Windows XP SP3**, or click **Turn Windows features on or off** on **Windows Vista SP2**, **Windows 7 SP1**, **Windows 8**, **Windows 8.1**, and **Windows 10**.



Internet Information Services

4. On **Windows Server 2003 SP2** and **Windows XP SP3**, select the **Internet Information Services** item on the list and click **Next**.
5. On **Windows Vista SP2**, **Windows 7 SP1**, **Windows 8**, **Windows 8.1**, and **Windows 10**, locate the **Internet Information Services** item on the list and click **+** to expand all its sub-items.
6. Select, at least, the following options and click **OK**.
 - Web Management Tools
 - IIS Management Console
 - IIS Management Scripts and Tools
 - IIS Management Service
 - World Wide Web Services
 - Application Development Features
 - ASP
 - ISAPI Extensions

- ISAPI Filters
 - Common Http Features
 - Static Content
 - Default Document
 - HTTP Redirection
 - Security
 - Basic Authentication
 - Request Filtering
7. IIS then start its installation process (to install it, users must have an installation CD on **Windows Server 2003 SP2** and **Windows XP SP3**).
 8. Wait for this process to finish to configure IIS.

After installing IIS, e3web.asp, e3web2.asp, docwrite.asp, docwrite2.asp, and e3downloader.cab files must be copied to **C:\inetPub\wwwroot**. This folder is created during IIS installation. Apart from .asp files, E3 WebViewer installer (e3webviewer-x86-enu.exe) must be copied to this folder. This installer is used when a client machine accesses a server for the first time, in case E3 had not been previously installed on that machine. This file can be downloaded from Elipse's website.

IIS still needs to be configured to work correctly. Configuration is different in case IIS and E3 Server are on the same machine or on different machines. To configure it, please check the **E3 Installation Guide**, chapter **E3 WebViewer Installation**.

24.4.2 Viewing on Client Application

If a server is using a web server, such as IIS, type this server's address or IP on browser's address bar (for example, *http://servername/virtual_directory*, or *http://192.0.0.21/virtual_directory*), where *virtual_directory* is a directory created during IIS configuration (according to **E3 Installation Guide**).

During server's first access, browser starts component installation, in case they had not been previously installed, as stated at the beginning of this chapter. This component is signed by Elipse Software, and users must accept that installation to start its configuration.



WebView Installation

After installation, E3 WebViewer opens in a browser, and viewing a server's application. In the next access, it is not necessary to install components, and connection is faster.

NOTE: A client version must match a server version. For this, the installer (e3viewer-x86-enu.exe) on a server must always be the most updated version.

Hot-Standby is a feature that allows implementing a fail-over concept in a supervisory system. This concept consists in a possibility of having two servers (main and backup), one acting as a contingency of the other, that is, if a main server fails, a backup server immediately starts running, with no losses in this process. This is known as a *Standby* server.

Thus, E3 Hot-Standby tool aims at allowing a server to remain in standby, waiting for a possible failure of another server (an active server). Switching to an active server can be manual or automatic.

A manual switching is activated via E3 Admin menu on Windows Notification Area of the standby computer (the **Server - Activate** option). An automatic switching occurs when a standby server detects that a main server is not running anymore. A server can assume one of the following statuses:

- **Server under Maintenance:** This status is indicated in Domain server's settings. A server under maintenance does not participate in any Domain event
- **Active Server:** Only one server can be active in a Domain at a certain time. An active server is the one running the application (E3Run)
- **Standby Server:** Only one server can be in **Standby** mode in a Domain at a certain time. A standby server runs E3Run in **Standby** mode, and an application remains loaded, only waiting for a command to start operating. A backup server monitors an active server, and if it is not answering, a backup is then activated
- **Inactive Server:** A server switches to inactive when it is declared in a Domain, but it is neither selected as the **Main** nor as the **Backup** server. Even when inactive, this server monitors changes in a Domain file, and it may switch to an **Active** or **Standby** status if an active Domain is reconfigured


IMPORTANT: To run a redundant application in E3, it is necessary that all servers run the same software version, and also have a local updated copy of Domain files (.prj, .lib, etc.). A .dom file, however, is automatically synced by E3 Server, that is, changes made to a .dom file on one server are automatically copied to this .dom file on other Domain servers. To do so, a .dom file must exist at the same path on all servers.

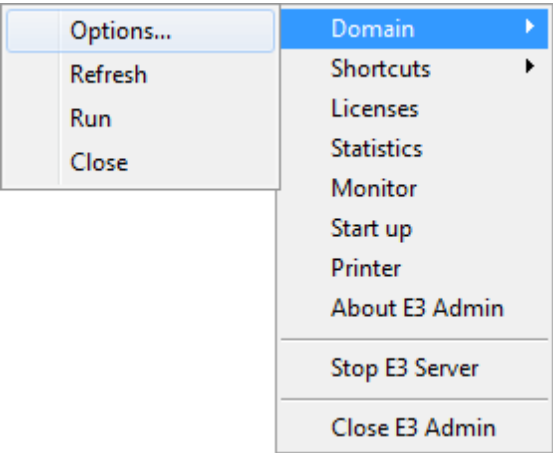
Hot-Standby uses a REC connection, therefore it only works if E3 Server is started up on all computers involved in this communication.

If an E3 Studio user or a Hot-Standby user is also an Administrator of a remote computer running E3 Server, they can remotely control this service by using **services.msc**, via the **Action - Connect to another computer** option.

25.1 Configuring

The settings to implement Hot-Standby are the following:




1. Locate the path of the Domain files (.dom, .prj, .lib, etc.) on the main computer and copy that folder to the standby computer. In case a different path to the Domain files has been set in the **Root folder for Domain files** option on **Servers** tab, users must use that path when copying those files.
2. Database files must be handled differently. For further information, see the topic **Using Databases with Hot-Standby**.
3. Go to the E3 Admin  icon on Windows Notification Area, and select the **Domain - Options** option.



E3 Admin

4. On **Servers** tab, add the main and backup servers. Configure the **Server Name** and **Network address** options, as described on topic **Domains - Domain Configuration - Servers**. For example:
 - **Server name:** Server1
 - **Network address:** \\Computer1
5. On **Options** tab, enable the **Hot-Standby - Enable** item. In the **Main server** field, select the project's main server, and in the **Backup server** field, select the project's backup server. E3 searches for a main server in alphabetical order.
6. Define the **PING addresses to check network integrity** option, as described on topic **PING addresses to check network integrity** of topic **Domains - Domain**


Configuration - Options.

7. Enable the **Activate backup server on local failure** option, as described on topic **Activate backup server on local failure** of topic **Domains - Domain Configuration - Options**.
8. Click **OK** to confirm these settings.
9. When starting E3, an icon represented by a yellow spinning bar  is shown on Windows Notification Area of all computers configured in Hot-Standby, indicating that Domains are being loaded. After a few seconds, E3 recognizes the main computer and indicates that status on Windows Notification Area with an icon represented by a green arrow . This icon specifies that this computer is currently running. The standby computer displays an icon represented by two yellow bars , indicating that it is in **Standby** mode.


25.2 Running a Redundant Domain

To run a redundant Domain, just start one of its servers; the other servers are automatically started by this first server. To start a Domain, create a shortcut to E3 Admin using the following command line:

```
E3Admin.exe -start <Domain_Path>
```

This server will start the Domain servers, and then it will be automatically closed. A Domain can be also started via E3 Studio. To do so, open the Domain and click .

25.3 Stopping a Redundant Domain

A Domain can be stopped by any of its servers, via E3 Admin  icon on Windows Notification Area. Select the **Domain - Stop** option, and then Active and Standby servers finish the E3Run process. A Domain can be restarted by selecting the **Domain - Run** option. If users select the **Domain - Close** option, the Domain is stopped and then closed, and E3 Servers are available to run other Domains.

IMPORTANT: These options to stop and close a Domain **AFFECT ALL DOMAIN SERVERS**, not only the server executing this command.

25.4 Stopping One of the Domain Servers

The correct way of stopping one of the Domain servers is by selecting it as in **Maintenance** mode, on **Servers** tab of E3 Admin **Domain - Options** settings. If the active server is in **Maintenance** mode, the standby server then switches to the active status. To set that server back into the Domain, deselect the **Maintenance mode** option of that server.

25.5 Switch Time Between Servers

The default time interval for a standby server to take over when the active server fails is 15 seconds. However, it is possible to configure this time via the **Time to activate backup server** item (as seen on topic **Domain Options**, chapter **Domains**).

This time interval allows the previous server to finish the application (in case of a network-only failure). This configured time directly affects the **ping** timeout among servers. If it is too low (switches every 1 second, **ping** timeout in 160 ms), there may be some spontaneous server switches, caused by minor network failures.

25.6 Viewer Reconnection

When there is a server switch, the Viewers start the reconnection process by trying to connect to the backup and to the active server, alternately. Users have the option to wait for the end of the reconnection process to the current Viewer, cancel the reconnection (and then close the Viewer), or open a new Viewer session with the new server.

25.7 Using Databases with Hot-Standby

Users can have two servers running separately in the same application. One of them remains active, while the other one remains in **Standby** mode, waiting for a possible failure.

Hot-Standby ensures application continuity, but when using a database, users must also ensure continuous access to that database.

There are two ways to solve this problem. In the first one, both applications access the same database. Users enable database access in the application, setting up a **DBServer** object on both servers (Main and Standby) with the same location parameters of the database on the network. To ensure system's continuity, it is important that the database be on a separate machine, accessible by both servers.

In the second way, data recording is performed on different databases. In this case, users must have two databases executing locally on both servers. Thus, users can ensure that access to these databases is always available, because the machine executing the application also runs the database.

An interesting option in this case is syncing between different databases of the main and secondary application. **DBServer's EnableSynchronization** property enables this feature in the application. When it is active, all data stored on the main database is updated on the Standby database almost instantly.

NOTE: If the main application cannot send data to a Standby server, then data remains stored on local disk for sending it later (when communication between these two computers is reestablished), ensuring that tables generated by the application are the same.

There are certain E3 configurations that can be performed directly in Windows Registry, although this procedure is not advisable. Elipse Software has a tool called **E3 Tweak**, which performs registry settings using a graphical interface. **E3 Tweak User's Manual** can be opened on the **Start - Programs - Elipse Software - Elipse E3 - Documentation - E3 Tweak Manual** menu. **E3 Tweak** can be opened using three different ways:

- Via **Start - Programs - Elipse Software - Elipse E3 - E3 Tweak** menu
- Via **Tools - E3 Tweak** menu in E3 Studio
- Via **Shortcuts - E3 Tweak** item of E3 Admin's contextual menu on Windows Notification Area

This chapter aims to answer frequently asked questions about E3. There are also errors that may occur and their solutions.

27.1 Tab Order

What is the relationship between creation order of objects on a Screen and their tab order at run time?

When creating a new object on a Screen, it receives the first position in tab order, and it is sorted in descending order relative to the other Screen objects. For more information about this issue, please check the topic **Tab Order among Objects**, on chapter **Screens and Screen Objects**.

27.2 Overlaying Animations in Objects

I created a Rotation or Translation Animation on a Screen, but I decided to change it, creating a new Animation. However, when running this application, this object appeared as the initial Animation, not as the current one. Why is this happening?

POSSIBLE CAUSE

This new Animation was created without removing the old one.

SOLUTION

To solve this issue, follow these procedures:

1. Right-click the desired object and select the **Remove animation** option.
2. Apply the new Animation.

NOTE: Do not try to remove an Animation from an object using the Organizer, because this action removes the object itself.

27.3 Screen Objects

I cannot rotate a picture inserted using the Gallery. Why is this happening?

Users must convert it to a symbol. This allows using commands and options available to native E3 objects. For example, using a Rotation.

27.4 SQL Server Databases

This is a list of all possible errors that may occur when testing a connection to this Database:

ErrorLocal = Open Connection ErrorError #0x80004005 Description:[DBNETLIB] [ConnectionOpen(Connection()).]SQL Server does not exist or access denied. (Source: Microsoft OLE DB Provider for SQL Server) (SQL State: 08001) (NativeError:17)

POSSIBLE CAUSE

Wrong Server Name on a DBServer configuration, or this user has no access to that database.

SOLUTION

Check the server name and if this user has permission to connect to that database.

ErrorLocal = Open Connection ErrorError #0x80040E4D Description: Login failed for user 'WrongUser'.(Source: Microsoft OLE DB Provider for SQL Server) (SQL State: 42000)(NativeError: 18456)

POSSIBLE CAUSE

Wrong user name or password.

SOLUTION

Use an user registered on that database or check the password used.

ErrorLocal = ExecuteSql ErrorError #0x80040E14 Description: There is already an object named 'E3Index' in the database. (Source: Microsoft OLE DB Provider for SQL Server) (SQL State: 42000) (NativeError: 1750)

POSSIBLE CAUSE

There is already an object (table, key, index, etc.) on this Database with the same name.

SOLUTION

Change this object's name.

27.5 Oracle Databases

This is a list of all possible errors that may occur when testing a connection to this Database:

Error = ORA-01017: invalid username/password; logon denied**POSSIBLE CAUSE**

Message generated on application log when password or user name is wrong.

SOLUTION

Check if this user exists and if password is correct.

Error = ORA-12154: TNS: could not resolve the connect identifier specified**POSSIBLE CAUSE**

This client connection was not found.

SOLUTION

Check if this connection exists on the computer and if it is working using one of the network utilities provided by Oracle.

Error = ORA-02264: name already used by an existing constraint**POSSIBLE CAUSE**

There is already a Database object with this name.

SOLUTION

To prevent this error, create and configure different index or primary key names in E3.

Error = ORA-01403: no data found**POSSIBLE CAUSE**

This message is generated when an internal E3 Query searches for Database objects and does not find them (for example, a Historic table does not exist, thus it must be created).

SOLUTION

This is considered an error only if it persists on application logs.

Error = ORA-00001: unique constraint (SYSTEM.E3INDEX) violated**POSSIBLE CAUSE**

Whenever there is an attempt to write a record where a field defined as the primary key has a duplicated value, this writing is refused and this message is displayed. Note that a key name is displayed (in this case, **SYSTEM.E3INDEX** key) as **User.KeyName**. Depending on the project, this error is expected, but most of the time it is important to check if this key is adequate. These two cases illustrate that

situation:

- **Power Measurement Systems:** Aiming to store all data from a single day, routines used for collecting admit upper and lower tolerances in their timestamps for the collecting process. Thus, some records must be written more than once. In this case, this error is expected
- **Alarm maintenance:** For this case, there may have been more than one error per second on an application. If the **E3TimeStamp** field is used as a primary key, there may have been losses of some alarm occurrences, which may lead to a misinterpretation of events. In this case, rethinking a primary key can be the adequate solution

SOLUTION

There are two ways to solve this issue:

1. Users must create a unique index for these key fields.
2. Users must check that application so that it does not send repeated key values for recording.

27.6 Data Server

The Retentive property of an Internal Tag is not working, because it does not save the last value when stopping a Domain. What can be wrong?

The **Retentive** property is not aimed to do this. It is only useful in Hot-Standby applications, to keep an Internal Tag value when there is a server switching.

How to save the value of an Internal Tag when stopping a Domain?

By using Data Server's **Save** method.

How do I display the current system date and time on a Screen in my application?

Create a **CurrentTime**-type Demo Tag and link it to a Display on this Screen. A date and time format can be configured on the **Formatting** tab of a Display properties window.

How do I create a timer in E3?

By using a **Square**-type Demo Tag. This Tag must have its **Enabled** property set to False and its **Period** property set to twice the limit time, in milliseconds. By setting True to its **Enabled** property starts counting time. To run any script at the end of this timer, create an event linked to this Demo Tag's **Value** property, which is executed when that property changes its value. In this script, users must also disable that Demo Tag, that is, set its **Enabled** property to False, so that it stops changing. It is recommended to use Demo Tag's **Reset** property before setting its **Enabled** property to True.

27.7 I/O Drivers

What do I have to do to use bits of an I/O Tag?

To use bits of an I/O Tag, users must enable I/O Tag's **UseBitFields** property.

How is the counting process of Block Tags and bits of Tags in E3?

The counting process considers I/O Tags and the size of Block Tags. Bits are not part of this counting process.

What is the easiest way to perform a blink in the color of a Screen object when there is an I/O error?

Create a Digital Link between this object's **ForegroundColor** property and the expression **TagName.Quality < 192**, with its blink option enabled. The **Quality** property represents the status of Tag's value quality, in OPC standard, and it may vary from 0 to 255, and that quality is good only above 192.

How can I display I/O errors on Screen?

By enabling Viewer's **View communication errors** option, on **Communication Errors** tab.

How can I change the default color of I/O errors in SetPoints and Displays?

Go to Viewer's properties window and change that color on **Communication Errors** tab.

27.8 Alarms

There was an error in the number of columns of a CSV file when importing an Alarm of type <typename>. Would you like to proceed the import of the other Alarms, ignoring these errors?

POSSIBLE CAUSES

A CSV file with Alarms to import has an error in its columns of the indicated type. Alarm files must always have the minimum number of columns expected, according to every type. Extra columns are skipped. To know the correct way to create a CSV file for Alarms, please check topic **Generating a CSV File Manually**, on **E3 Studio** chapter.

SOLUTION

There are three possible answers to that question in the error message:

- **Yes:** This process of importing Alarms inside this CSV file proceeds, ignoring

only this error about the number of columns. The Alarm whose columns are incorrect is not imported

- **Yes (All):** This process of importing Alarms proceeds, ignoring all subsequent Alarms with error in the number of columns that may exist in that CSV file
- **No:** The process of importing stops, but Alarms already imported are preserved

To prevent this error, this CSV file must be created according to recommendations on chapter **Alarms**.

IMPORTANT: Although Tag and Alarm files have the same extension (.csv), internally they are different. Hence, an Alarm file is not suited for Tags and vice versa.

I created a CSV file manually, containing an Alarm configuration. How can I import it?

Check Region and Language configurations on Windows Control Panel, and if the decimal separator is the same used in this CSV file. **TIP:** create an Alarm in E3 and use the export tool, using the resulting file as a template for generating new Alarms.

How can I display an E3TimeStamp field with milliseconds in E3Browser and in E3Alarm?

Use the **Others** format, and type "MM/dd/yyyy HH:mm:ss.000". This configuration for an E3Browser is performed on **Data Source** tab, on **Format** column of each field. For an E3Alarm, such configuration is performed on **Columns** tab, by clicking **Properties** on each field.

The following error message appears: "Impossible to create alarm signatures on the Alarm Server with filter. Error code: (0x800706F7)". What does that mean?

The name of this Alarm Server is not specified in the E3Alarm, or it is not correct. For an E3Alarm to capture and display active Alarms, users must configure the name of an Alarm Server to access. To do so, change the value of **Alarm Server** column of the desired Connection on **Connections** tab of E3Alarm's properties window, or use the Properties List and select the **AlarmServer** property.

How can I delete Tags linked to Alarms and Areas on an Alarm Configuration object?

- **To delete a Tag linked to an Alarm:** Select this Tag with the mouse and press the DELETE key
- **To delete an Alarm:** Select this Alarm with the mouse and press the DELETE key
- **To delete an Area:** Select this Area and press the DELETE key

How to display "High", "Medium", and "Low" messages in an Alarm's Severity field instead of values 0, 1, and 2 in a SQL query?

The SQL syntax for every database supported by E3 is the following:

- **Access:**

```
SELECT InTime, OutTime, Message, FormattedValue,  
       IIF(Severity = "0", "High",  
       IIF(Severity = "1", "Medium", "Low"))  
       AS Severity FROM Alarms;
```

- **SQL Server:**

```
SELECT InTime, OutTime, Message, FormattedValue,  
       Severity = CASE Severity  
       WHEN 0 THEN 'High' WHEN 1 THEN 'Medium'  
       WHEN 2 THEN 'Low' END FROM Alarms;
```

- **Oracle:**

```
SELECT InTime, OutTime, Message, FormattedValue,  
       DECODE(Severity, 0, 'High', 1, 'Medium', 2, 'Low')  
       Severity FROM Alarms;
```

27.9 E3Alarm

Alarms do not display in an E3Alarm. Why is this happening?

POSSIBLE CAUSES

To check an E3Alarm configuration, verify if the server name is correctly configured. Another possibility is the existence of more than one Alarm Server in a Domain, which can cause trouble. Another error situation would be a filter configured for a non-existent Alarm Area.

SOLUTION

Make sure that there is only one Alarm Server in this Domain, and that all Alarms are correctly configured. Also check if this configured Area exists.

How can I create a filter for two or more Areas in an E3Alarm?

First, group these Areas into a main Area. Then, use names with the same characters at the beginning. Example: ALM1MEC, ALM1ELE, ALM2MEC, ALM2ELE, etc.

How do I acknowledge Alarms with a double-click?

Enable the **Acknowledge Alarm** option, located in the properties of the desired column in an E3Alarm, on **Columns** tab.

27.10 E3Browser

How to limit the number of records to display on an E3Browser?

This item can be configured in E3Browser's Query. Enable the check box **Return a maximum of ... records**, specifying the maximum number of records to return. Another option is to optimize this Query by using filters to narrow the period of time, the number of columns or records involved, etc. For this, please check the chapter **Query**.

27.11 E3Chart

Is it possible not plotting a Tag value when its quality is bad, in a historical E3Chart?

Yes. By using scripts, it is possible to configure an E3Chart to perform this.

```
Set Pen = Screen.Item("E3Chart1").Pens  
Pen.Item("Pen Name").ShowBadPoints = False
```

Notice, however, that this solution is only valid for historical values. At run time, this value is always plotted, regardless of Tag quality.

27.12 Historic

How to disable recording of historic records by scan?

Configure the **Interval between records (ms)** option on **Historic** tab of Historic's properties window with a value of 0 (zero). If users want to perform this by script, property's name is **ScanTime**. Thus, values are not recorded automatically, forcing a recording via script using the **WriteRecord** method.

27.13 Links

How to create an Expression Tag in E3?

Linking an Internal Tag's **Value** property to this expression. This expression can be simple and may contain arithmetical and logical operators involving constants and other Tags.

How can I change the color of an object when moving the mouse over it?

Creating a Digital Link between object's **ForegroundColor** and **MouseOver** properties. The **MouseOver** property has a **Boolean** type, and assumes a True value when mouse is over this object and False when the mouse is outside this object's area.

How can I create a multilingual application?

There are two ways of performing this. One is creating an Internal Tag in Viewer for each **String** and link these Tags to these properties to translate (or use Tags on scripts in case of using the **Msgbox** method). Then, create a table with all application **Strings**, where the first column is the name of an Internal Tag created in Viewer, and each subsequent column contains a **String** corresponding to a language. This table can be created in Access, for example. When opening Viewer and defining a language, load Viewer's Internal Tags with a table of **Strings** corresponding to the selected language. This can be performed using a Query object on a Screen. Here is an example of a script:

```
Sub Screen1_OnPreShow(Arg)
    Set rs = Item("Query1").GetADORecordset()
    rs.MoveFirst
    For i = 1 To rs.RecordCount
        Application.Item(rs.Fields("TagName").Value).Value = _
            rs.Fields(Arg).Value
        ' Arg is a parameter passed to the Screen
        ' containing the name of the column
        ' referring to the chosen language
    rs.MoveNext
    Next
End Sub
```

Another way is creating a Table Link in all properties with translatable content, using the same source for all Links. For each value range of this Link, place a **String** referring to a different language. The source can be an Internal Tag whose value can be defined when opening Viewer. In case of using the **MsgBox** method, use the same Tag as a condition to choose which **String** is used.

27.14 Viewer

I cannot connect a remote Viewer to a Server. Why is this happening?

POSSIBLE CAUSE

There is a firewall blocking access to this Server.

SOLUTION

Users must unblock all ports used by E3. The procedure to unblock a port on Windows firewall is described next.

NOTE: The default port used by E3 is 6515, but this behavior can be changed according to topic **Running E3 Viewer - Via Start Menu**.

Windows XP SP3

1. Go to the **Start - Control Panel** menu.

2. Click **Security Center**.
3. Click **Windows Firewall**.
4. Select the **Exceptions** tab and click **Add Port**.
5. Type a name and a port number to unblock. Leave the **Protocol** option selected as **TCP**.
6. Click **OK** to save these changes.

Windows Vista SP2

1. Go to the **Start - Control Panel** menu.
2. Click **Windows Firewall**.
3. Select the **Exceptions** tab and click **Add Port**.
4. Type a name and a port number to unblock. Leave the **Protocol** option selected as **TCP**.
5. Click **OK** to save these changes.

Windows 7 SP1, Windows 8, Windows 8.1, and Windows 10

1. Go to the **Start - Control Panel** menu.
2. Click **Windows Firewall**.
3. Click **Advanced Settings**.
4. Right-click the **Outbound Rules** item and select the **New Rule** option.
5. On **Rule Type** window, select the **Port** item and click **Next**.
6. On **Protocol and Ports** window, select the **TCP** option and, on **Specific remote ports** item, type the number of a port to unblock and click **Next**.
7. On **Action** window, select the **Allow the connection** item and click **Next**.
8. On **Profile** window, leave the **Domain**, **Private**, and **Public** options selected and click **Next**.
9. On **Name** window, type a name and a description (optional) for this port and click **Finish** to save these changes and close this window.

I cannot open a remote Viewer using Internet Explorer. Why is this happening?

POSSIBLE CAUSES

- Viewer is not installed in the remote computer
- There is a firewall blocking access to this server

SOLUTION

Users can install Viewer on the remote computer or else copy Viewer's installation file to Server's folder **C:\inetpub\wwwroot**. Thus, every time there is an attempt to open a Viewer using Internet Explorer on a remote computer where Viewer is not installed, the installation process starts immediately.

27.15 Libraries

When opening a Screen, there is a message declaring that an object cannot be correctly loaded

POSSIBLE CAUSE

An XControl of a Library that was being used inside this Screen was deleted, or else a Library that contains this XControl was removed from a Domain.

SOLUTION

In the first case, if this XControl was deleted, there is no way to recover it. To fix this error, remove the ElipseX object that is inside a Screen (in the Organizer users can see an exclamation point over object's icon. On a Screen there is a black square with an X inside it). In the second case, add this Library to a Domain.

When opening a Screen, there is an error message declaring that an ActiveX library cannot be opened

POSSIBLE CAUSE

Some ActiveX objects used on that Screen were not registered and added to this computer.

SOLUTION

Register and add this ActiveX object by using the **Add ActiveX** option, available on **Tools** menu. For this, users must have an OCX file that contains this library.

When inserting an ActiveX object on a Screen, an error 80040112 occurred. What does it mean?

POSSIBLE CAUSE

This error indicates that the inserted ActiveX object is not licensed on this computer. During the instantiation process, this control searches Windows Registry for its license key (**HKEY_CLASSES_ROOT\Licenses**) and, in case it does not find it, returns this error. There are development license keys for ActiveX objects, as well as run time license keys.

SOLUTION

To solve this problem, users must purchase an ActiveX license and register it in this computer.

I have two Libraries in a Domain, but I cannot use them at the same time. When I register one, the other one stops working. How can I solve this problem?

Probably, one of these Libraries was created as a copy of the other one, and thus both have the same ID. Therefore, users must remove one of them from this Domain.

27.16 Reports

How can I add the current date and time on an E3 Report?

There are at least two alternatives to solve this:

- Add a Label on **Page Header** Section and on **Page Header** Section's **OnFormat** event, type the following script (*Label1* is Text's name):

```
Report.Sections("PageHeader").Controls("Label1")._Caption = Now
```

- Create a **CurrentTime**-type Demo Tag. On Report's header or footer, users must insert a SetPoint object and, in the **DataField** property, type Tag's full name (for example, "Data.DemoTag1.Value"). Configure the desired date format. This can be performed by right-clicking an object and setting its properties, or else directly typing a format in the **OutputFormat** property, in the Properties List (an example of date format is "MM/dd/yyyy hh:mm:ss").

I have a Report that displays a Query result with a filter by date. When this Report is generated, its Query does not return all values configured via script for these variables. How can I solve this problem?

Check, in the script that configures or accesses this Report, if after configuring these values for Query variables a **LoadReport** method was not triggered, since this method loads a Report with all settings performed in E3 Studio. Use only once the **LoadReport** method in a script, loading a Report to a variable (using the **Set** command).

How can I correctly run a Report that uses the CopyConfig method to copy all configurations of an E3Chart on a Screen to it?

The **CopyConfig** method does not copy values of query variables, this must be performed using scripts inside a chart. Pens configured in an E3Chart on Screen are of type **Real**.

How can I create a filter by date on a Report?

Create a SQL query in a Report filtering by start and final date. On a Screen that generates this Report, users must run the configured SQL query, passing the start and final date values. The script of a button on the Screen where this Report is

generated, for example, can be implemented this way:

```
StartDate = CDate(Screen.Item("StartDateText").Value)
EndDate = CDate(Screen.Item("EndDateText").Value)
Set Report1 = Application.LoadReport("Report1")
Set Query = Report1.Item("Query1")
Query.SetVariableValue "StartDate", (StartDate)
Query.SetVariableValue "EndDate", (EndDate)
Report1.PrintPreview()
```

How to display dates used as a filter on a Query of a Report's Page Header?

First, add two SetPoints on **Page Header** (one to display the start date and another one to display the end date) and create a script that passes those values loaded on Screen SetPoints (and transferred to that Query) to these two SetPoints. The script to be created on **Page Header** object, on Report's **OnBeforePrint** event, can be as follows:

```
Set data = Application.GetFrame().Screen
Report.Sections("PageHeader").Controls("Field5").Text = _
    data.Item("StartDateText").Value
Report.Sections("PageHeader").Controls("Field6").Text = _
    data.Item("EndDateText").Value
```

Then, link two Internal Tags to Screen's SetPoints where dates are specified. Link these Tags to Report's SetPoints.

How do I print two Reports on distinct printers?

Create the following script on Report's **OnReportStart** event:

```
Sub OnReportStart
    Report.Printer.DeviceName = "Printer Name"
End Sub
```

How do I use an OnError script event to display an error message when printing a Report fails?

Report's **OnError** event does not allow running scripts inside it, having only internal purposes. This means that it is not possible to change this error message, nor execute any other procedure on this event.

27.17 Domains and Projects

What happens to events generated by the E3 Server while the Domain is not running?

As long as the event recording is enabled, E3 Server logs the generated events on an internal event list (in memory). This list is emptied in three situations:

- If there is an E3Run running locally (that is, the E3 Server is in the **Hot** state),

the events of this list are sent to the E3Run for recording on the Database. If the recording works, the recorded events are removed from the list

- If there is another E3 Server running in **Hot** state on the Domain, messages are sent to that E3 Server
- If the Domain is closed, all messages not yet stored are discarded

I have used E3 Admin via command line and an error has been displayed. Why has this happened?

Sometimes, when using E3 Admin via command line, users may wrongly configure a parameter, which throws an error message. The following error messages can be displayed:

- **The Domain could not be opened because the file 'filename.dom' is read-only**
 - This message appears when the Domain file is read-only
- **The options are not valid or the Domain name is incorrect. Check the informed options and whether the Domain exists**
 - This message appears when a non-existing option or Domain name is informed, or the Domain file is not found, probably because an invalid Domain path name was informed
- **The Domain name was not informed**
 - This message appears when the **-viewer** or **-start** options are used without the Domain name. For more information, check the chapter **Domains**

How two or more users can work at the same time on the same Domain?

Creating a Domain via network, several users can open it on different computers and work on it at the same time. The changes made by one users are visible to the other ones, as soon as they open the specific changed object or as soon as they update the changed project or Library.

What is the effect of clicking Update on the project menu?

All project objects are updated. For example, if several users are working at the same time on the Domain, changes saved by one user are visible to the other ones, as soon as they open the specific changed object or when they update the changed project or Library.

27.18 Stored Procedure

How do I run a Stored Procedure in E3?

The easiest way is by creating a Query in E3 with the command to execute the Stored Procedure and passing, if necessary, values to it. The command that must be configured on this Query is the following:

```
Exec StoredProcedureName <%var1%>, <%var2%>, ...
```

Where the syntax of variables must be the "<" (less than) character, the percent ("%") character, the name of the variable, the percent ("%") character again, and finally the greater than ">" character. Values *var1* and *var2* are the variables the Stored Procedure is waiting for (for example, start and end date). If the Stored Procedure is not waiting for any variable, create the SQL command without variables. To execute this Query, use the **Execute** method.

NOTE: E3 Query's **CursorLocation** property must be configured as **1 - clClient**.

27.19 Remote Domains

How does Remote Domain licensing works?

The E3 Server running the Client Domain, as well as the one running the Server Domain, must have a specific license for Remote Domains. When this license exists, the E3 Server running as Server Domain starts accepting an unlimited number of external connections from other Domains. Likewise, in case of a Client E3 Server, it is possible to establish an unlimited number of connections. For more information about limitations of E3's **Demo** mode, please check the topic **Limitations of Demonstration Mode**.

When communication between a Client and a Server Domain drops, what happens?

When an error situation happens, all Links from the client application referring the Domain are disconnected (Displays, for example, show an I/O error message, according to Viewer settings), as well as all **Application.GetObject** methods referring the Remote Domain fail (that is, cause script errors). When the problem is solved, Links should reconnect automatically. However, **Application.GetObject** methods must be executed again.

A Client Domain can view Alarms from other Remote Domains?

Yes, starting with E3 version 3.1 users can view and acknowledge alarms in Remote Domains by using, in E3Alarm's **AlarmServer** property, the syntax **REMOTE_DOMAIN:ALARM_SERVER**, where **REMOTE_DOMAIN** is an alias given to a Remote Domain on **Remote Domains** tab of Domain configuration and **ALARM_SERVER** is the name of an Alarm Server. For versions earlier than 3.1, users

must duplicate Alarms in a Remote Domain.

A Client Domain can open Screens from other Remote Domains?

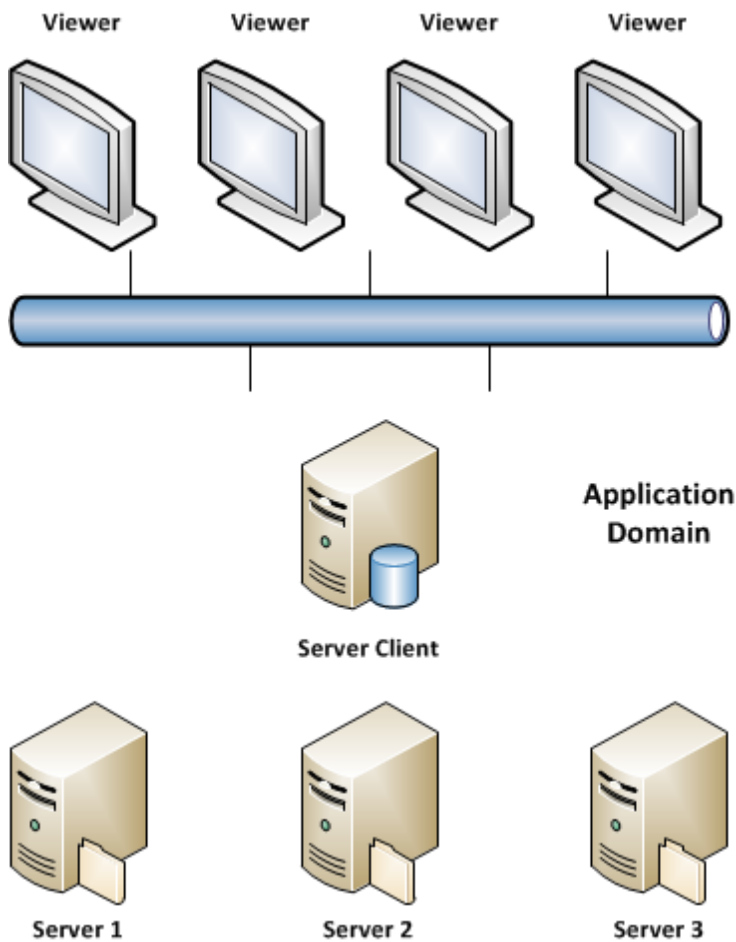
No, it cannot.

A Client Domain can use users from other Remote Domains?

No, it cannot.

Is it possible to connect one Domain to several other Domains?

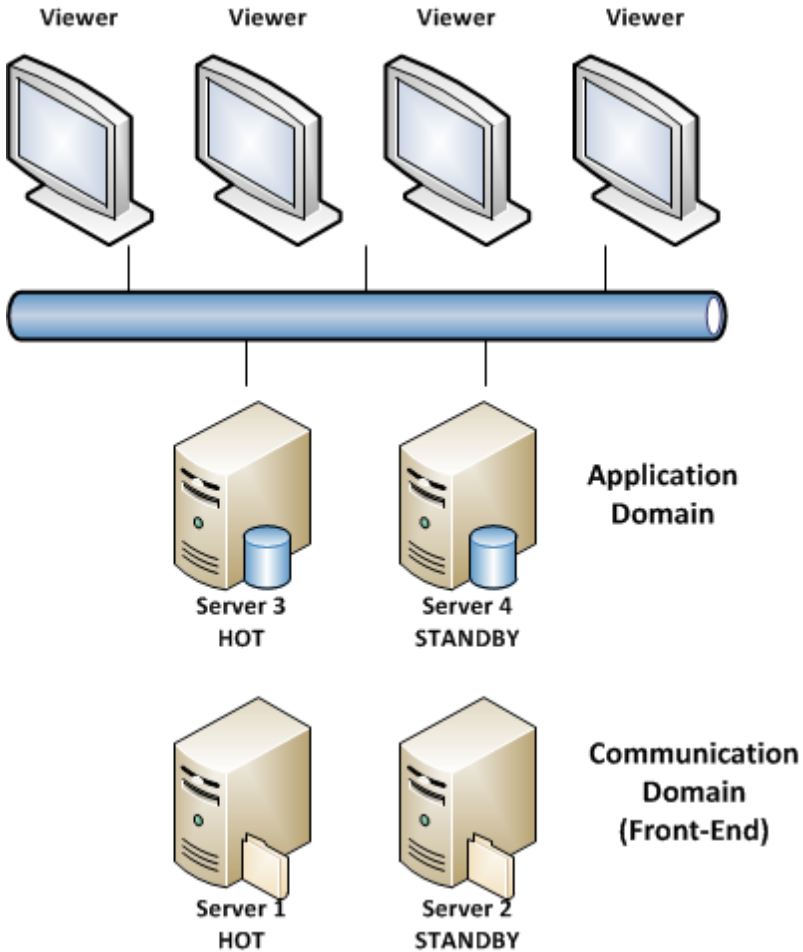
Yes, it is, as seen on the next figure.



Connecting one Domain to several other Domains

Is it possible to connect one Domain to a Domain in Hot-Standby?

Yes, it is. Consider the architecture of the next figure.



Connecting one Domain to a Domain in Hot-Standby

By using Remote Domains this architecture is possible. There is an I/O Domain, in Hot-Standby, communicating with devices. This data is read by another Domain, also in Hot-Standby, which would be the server for client computers (Viewers).



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